COLORADO
Air Pollution Control Division
Department of Public Health & Environment

Date: February 13, 2026

Via Email:

Dan Glazer
19650 Winter Park Ave
Aurora, CO 80011
216-789-4585

RE: Request of Trade Secret or Confidential Business Information designation

Dear Mr. Glazer

The Air Pollution Control Division (Division) received materials which have been requested to be designated as Trade Secret or Confidential Business Information.

For the application received by the division on 11/17/2025 to add engines to permit number 19AR0178.

1. ☐ The Division agrees with the designation of Trade Secret or Confidential Business Information. The redacted version will be available for release, with a copy of this letter. The un-redacted version will be segregated and managed in a manner to maintain confidentiality of the materials.

   Or;

2. ☒ The Division has evaluated the claim of Trade Secret/Confidential Business Information and has determined that the information is not entitled to confidential treatment. The information is emissions data and will be available for release.

   (11.5) "Emission data" means, with reference to any source of emission of any substance into the air:

   (a) Information necessary to determine the identity, amount, frequency, concentration, or other characteristics (to the extent related to air quality) of any emission which has been, or will be, emitted by the source (or of any pollutant resulting from any emission by the source), or any combination thereof;

   (b) Information necessary to determine the identity, amount, frequency, concentration, or other characteristics (to the extent related to air quality) of the emission which, under an applicable standard or limitation, the source was authorized to emit (including, to the extent necessary for such purposes, a

description of the manner or rate of operation of the source), or any combination thereof;

(c) A general description of the location or nature, or both, of the source to the extent necessary to identify the source and to distinguish it from other sources (including, to the extent necessary for such purposes, a description of the device, installation, or operation constituting the source).
Colorado Revised Statutes 25-7-103(11.5)

Or;

3. ☐ The Division has evaluated the claim of Trade Secret/Confidential Business Information and has determined the information is readily available or generally known. This information will be available for release.

If the Division has determined that the request for Trade Secret or Confidential Business Information designation **will not be applied** to materials submitted, the materials will be available for release 10 business days from the date of this letter. Please contact the Division if you wish to discuss further.

Please let me know if you have any questions. Kenneth.Houlden@dphe.state.co.us

Sincerely,

KC Houlden
Construction Permits Unit Supervisor
Air Pollution Control Division
Colorado Department of Public Health and Environment

Copy to file

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CONSTRUCTION PERMIT APPLICATION

Amazon Data Services, Inc.

DEN-22
Facility AIRS ID 005-1722

Prepared By:

TRINITY CONSULTANTS
1999 Broadway, Suite 820
Denver, CO 80202
(720) 638-7647

October 2025

Project 240601.0149

Trinity Consultants

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Permit Application/Registration Checklist
Form APCD-100

- A complete permit application must include the documentation outlined in this form unless otherwise noted.
- If the permit application does not include the required documentation, **it may be rejected.**
- Filing fees for permit applications that are rejected due to incompleteness **will not be refunded.**
- Certain types of emission sources may require additional forms. Refer to the Division's APENs and air permits webpage to see whether any APEN supplement forms are required for your source.
- If the application is for a major NANSR or PSD permit, send eight (8) total copies.

Company Name: Amazon Data Services, Inc.

Facility/Site Name(s): DEN-22

What type of permit coverage is requested by this application?

- [x] Traditional construction permit
- [ ] General permit (e.g. GP01, GP03, etc.)

Are you requesting (an) individual or facility-wide permit(s)?

- [ ] Individual permit(s) covering (a) single emissions point(s).
- [x] Facility-wide permit covering multiple emissions points.

Check one box in each section of the following table to certify that the referenced documentation is included with the permit application. Do not check more than one box per section unless otherwise noted.

Section	Description of Required Permit Application Element
A	[x] The relevant filing fee(s) are being submitted with this application, or were already submitted.
B	[x] This application contains the relevant Air Pollutant Emission Notice(s). (APCD Form Series 200)
C	[x] This application contains relevant emission calculations and supporting documentation.
D	[x] This application contains company contact information documentation. (Form APCD-101) [ ] There is only a single point of contact for this application. (Form APCD-101 is not required.)

(Checklist continued on next page)

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Required Permit Application Element Checklist (continued):

E	**Environmental Justice Documentation** ☑ A complete Environmental Justice (EJ) Summary for this project was submitted prior to this application, and was reviewed and verified by the Division. The verification number for this EJ Summary is 85952234. ☐ This application is exempt from EJ Summary requirements for the following reason(s), per Colorado Regulation Number 3, Part B, Section III.B.5.e. (check all that apply): ☐ This application is only for an administrative permit amendment. (Section III.B.5.e.(i)) ☐ This application requests an overall decrease or no change in the facility-wide annual emission limits of NOx, VOC, $PM_{2.5}$, and BTEX pollutants. (Section III.B.5.e.(ii)) ☐ This application is for a modification at an existing source of emissions, and an up-to-date EJ Summary was already verified by the Division on _____. (Section III.B.5.e.(iii))
F	**Ambient Air Impact Analysis Documentation** ☐ This application is exempt from modeling determination requirements for the following reason(s), per the document Permitting Section Addendum to the Modeling Guideline (2/21/2024) (check all that apply): ☐ "No Emission Increases or 'Pure Decreases' in a Permit Modification" (Section 2.1) ☐ "Only VOC Increases" (Section 2.2) ☐ "APEN-exempt and Permit-exempt Emission Sources" (Section 2.3) ☐ "Land Development Projects Requesting Coverage Under a General Permit (GP03)" (Section 2.4) ☐ A request for modeling determination for the project(s) included in this application has been submitted, and the Division determined that additional modeling was not required. This application contains the version of the modeling determination request that was **reviewed and approved by the Division**. (Form APCD-114) ☑ This application is for a traditional construction permit, and a modeling analysis for the project(s) included in this application has been submitted, but not yet approved by the Division. ☐ A modeling analysis for the project(s) included in this application has been approved by the Division. This application contains any relevant documentation of this approval, including the submitted modeling analysis and the Division's modeling review comments which document compliance with the NAAQS and the conditions of approval for the proposed project(s). ☐ This application is for a traditional construction permit, and a NAAQS monitoring plan is being submitted with this application, or has already been submitted. If this monitoring plan has already been reviewed and approved by the Division, this application contains the plan itself and documentation of plan approval.

(Checklist continued on next page)

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Required Permit Application Element Checklist (continued):

G	**General Permit Monitoring Compliance Documentation** ☑ This application is: **A)** requesting coverage under a traditional construction permit, **and/or B)** the emission source(s) contained in this application are **not** located in a Disproportionately Impacted (DI) Community. (For the following three options) This application is requesting coverage under a general permit, the emission source(s) contained in this application are located in a Disproportionately Impacted (DI) Community, and: ☐ This source will comply with source-specific monitoring requirements as outlined in Regulation Number 3, Part B, Section III.J.2. ☐ This source will pay community monitoring fees as outlined in Regulation Number 3, Part B, Section III.J.3. ☐ This source will comply with well production facility monitoring requirements as outlined in Regulation Number 3, Part B, Section III.J.4. ☐ This source is not subject to Regulation Number 3, Part B, Sections III.J.2., III.J.3, or III.J.4.
H	☑ This application contains a facility-wide emissions inventory. (Form APCD-102 for oil & gas sources, or form APCD-102a for non-oil & gas sources)
I	☑ This application contains a process description, flow diagram, and plot plan of the emissions unit and/or facility, as relevant.
J	☐ This application contains the relevant Operating & Maintenance (O&M) Plan documentation. (APCD Form Series 300) ☑ This application is: **A)** for a true minor source of emissions, **and/or B)** for an emissions source that is not associated with the oil & gas industry, **and/or C)** requesting coverage under a general permit. (APCD Form Series 300 is not required.)

Applicant Certification:

I hereby certify that all information contained herein and information submitted with this application is complete, true, and correct.

Signed by: Robb Truedinger 83B51630A138463...

Signature of Legally Authorized Person (not a vendor or consultant)

November 6, 2025

Date

Robb Truedinger

Name (print)

AWS Environmental Director

Title

Send the application with all required information/documentation (including this form) and any applicable fees to:

CDPHE - Air Pollution Control Division
APCD-SS-B1
4300 Cherry Creek Drive South
Denver, CO 80246-1530

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1. EXECUTIVE SUMMARY

Amazon Data Services, Inc. (Amazon) owns and operates the DEN-22 Campus (DEN-22, Facility AIRS ID 005-1722) in Arapahoe County which provides back-up electric power. DEN-22 is authorized under Construction Permit 19AR0178, Issuance 3 (issued November 3, 2023) and is located at 19650 Winter Park Ave, Aurora, CO 80011.

Arapahoe County is within the boundaries of the Denver Metro-North Front Range (DMNFR) non-attainment area which is currently classified as severe non-attainment for the 2008 8-hour ozone standard and is attainment/unclassified for all other criteria pollutants and averaging periods. DEN-22 is located within an Air Quality Reg. 3 Disproportionately Impacted (DI) Community, specifically in a Socioeconomically Vulnerable (SV) Community.

DEN-22 is permitted for eighteen (18) diesel-fired emergency generator engines that provide mechanical power to electrical generators. With this application, Amazon is requesting to build Pad 2 as a modular addition which will consist of twenty-six (26) new diesel-fired emergency generator engines and one (1) house generator. Pad 2 is proposed to begin operation in the fourth quarter of 2026.

Table 1-1 below provides a summary of the proposed facility-wide potential-to-emit (PTE) emissions. Based on the estimated emissions for the project, DEN-22 will remain a synthetic minor source for the purposes of Non-attainment New Source Review (NNSR) and Title V (TV) permitting. Detailed emission calculations are further provided in Appendix C.

Table 1-1. Amazon DEN-22 Proposed PTE

Emission Source	PTE Emission (tpy)					
	$PM/PM_{10}/PM_{2.5}$	SO_2	NO_x	VOC	CO	Total HAP
Pad 1 Engines Emissions	0.50	0.01	11.76	1.39	6.69	0.01
Pad 2 House Engine Emissions	0.04	4.20E-04	0.50	0.07	0.30	3.38E-04
Pad 2 Emergency Engines Emissions	0.18	0.02	12.00	0.66	2.46	0.01
Total Emissions	**0.7**	**0.03**	**24.3**	**2.1**	**9.5**	**0.02**
TV/NNSR Major Source Thresholds (tpy)	**100**	**100**	**25**	**25**	**100**	**25**
Facility-wide Emissions > TV/NNSR Thresholds?	**No**	**No**	**No**	**No**	**No**	**No**
PSD Major Source Thresholds (tpy)	**250**	**250**	**250**	**250**	**250**	**-**
Facility-wide Emissions > PSD Thresholds?	**No**	**No**	**No**	**No**	**No**	**-**

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2. PROJECT DESCRIPTION

DEN-22 is an existing facility that is permitted for eighteen (18) 2,500 kW diesel-fired emergency generator engines. Currently, the engines at Pad 1 are permitted under Construction Permit 19AR0178, Issuance 3 (issued on November 3, 2023).

Amazon is proposing to add Pad 2, consisting of installation of twenty-seven (27) new diesel-fired emergency generator engines. The new engines include one (1) 2,000 kW house engine and twenty-six (26) 2,750 kW emergency generators for emergency power. Each of the twenty-six (26) 2,750 kW generator engines will operate with Selective Catalytic Reduction (SCR) systems, including catalyzed diesel particulate filters (cDPF), and diesel oxidation catalyst (DOC) add-on control technologies.

As part of this expansion of DEN-22, Amazon will be requesting a facility-wide NO_X emission limit of 24.3 tpy in order to remain a synthetic minor source for the purposes of NNSR and TV permitting. This facility-wide limit will allow for greater operating flexibility in the event of power outages at DEN-22 as not all engines at Pad 1 and Pad 2 may need to operate at the same time. Outside of usage for emergency power generation, the engines will periodically undergo operation for maintenance or testing.

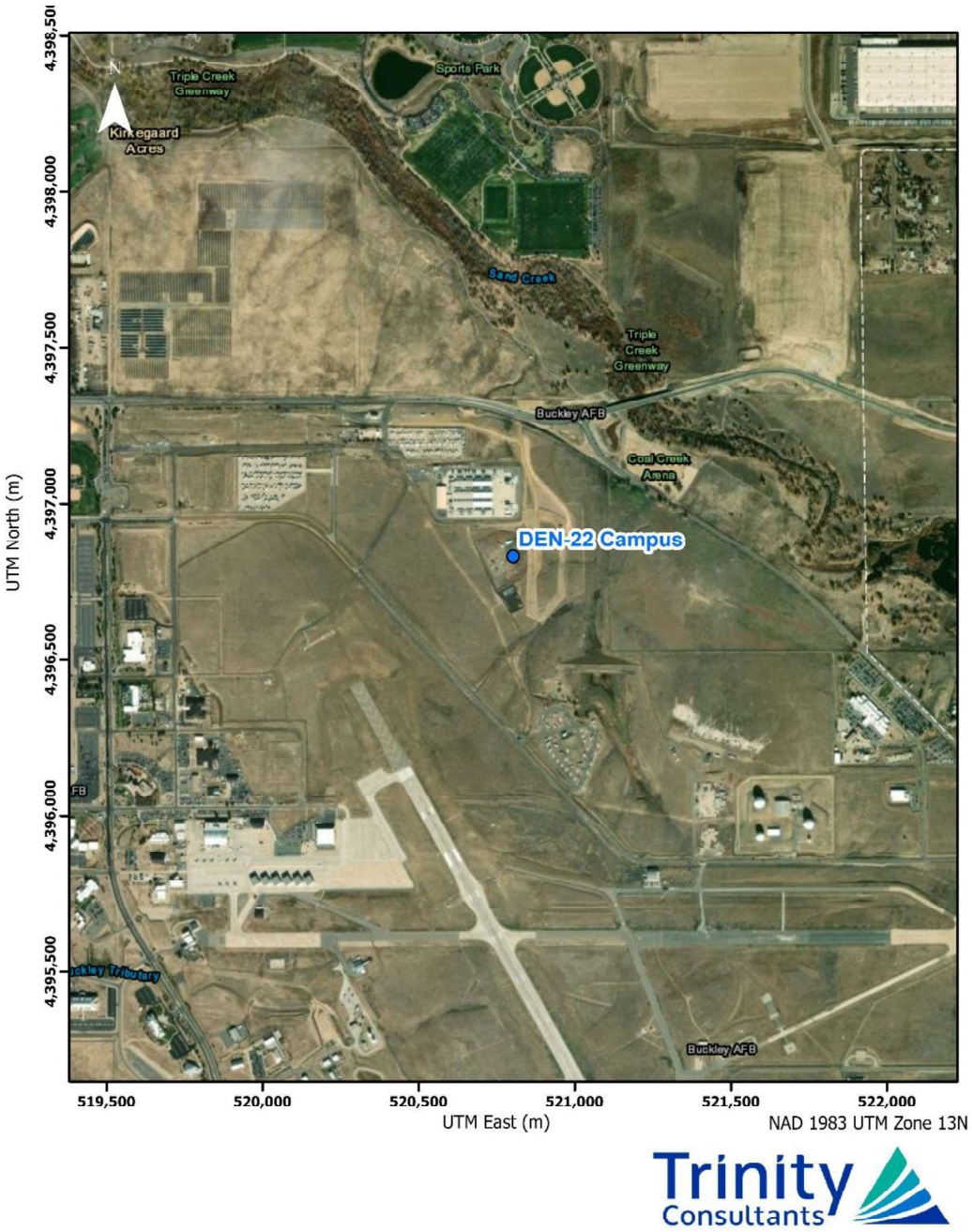
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3. AREA MAP

DEN-22 is located at 19650 Winter Park Ave, Aurora, CO 80011. An area map of the facility with respect to the surrounding topography is shown in Figure 3-1 below.

Figure 3-1. Area Map of DEN-22



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4. EMISSION CALCULATIONS

The following sections provide a detailed description of the methodology used to calculate emissions for sources at DEN-22. Detailed emission calculations are provided in Appendix C.

4.1 Diesel-fired Emergency Generators

All engines will be fueled with ULSD and/or renewable diesel meeting ULSD sulfur standards. The diesel-fired emergency generators engines have a maximum rated horsepower of 2,500 kW for the Pad 1 generators (currently permitted), 2,000 kW for the Pad 2 house engine (proposed), and 2,750 kW for the Pad 2 generators (proposed). The manufacturer has indicated that at the site elevation, the units are capable of achieving up to 85% load. Therefore, for the sake of emissions estimates, manufacturer data was used up to 85% load.

Emission factors for NO_X, CO, and VOC for all engines are determined using the manufacturer provided emission rates at 5 load levels (85%, 75%, 50%, 25%, and 10%). Emission factors in pounds per gallon (lb/gal) are calculated by dividing the manufacturer's emission rates provided in pounds per hour (lb/hr) by manufacturer's fuel consumption. The maximum calculated lb/gal emission factors for each generator engine type are used for this inventory.

Emission factors for these generator engines have been determined based off Not to Exceed (NTE) emission rates, provided under the "rated speed potential site variation" section of the manufacturer specifications (see Appendix C). It has been determined that the NTE emission factors provided by the manufacturer will represent a conservative estimate of emissions for the engines and therefore have been used in the assessment of facility impacts. The reported non-methane hydrocarbon (NMHC) is expected to be equivalent to VOC. The maximum calculated emission factors at any load for each generator engine type are used for this inventory.[1]

Total PM is based on the sum of the maximum manufacturer provided emission rate and the condensable PM emission factor from AP-42 Tables 3.4-2. The maximum manufacturer provided PM emission rate was determined by reviewing the emission rates at 5 load levels (similar to NO_X/CO/VOC). The emission factor for SO_2 is determined using mass balance, assuming a sulfur content of 0.0015% and a fuel density of 7.09 lbs/gallon.[2]

The 2,750 kW units will be equipped with control devices including SCR, DOC, and cDPF. The SCR provides control of NO_X emissions during normal operation. The catalyst associated with the SCR is only effective within a specific temperature range. Typically, the SCR catalyst bed temperature required to initiate urea injection is expected to be attained in approximately 10 minutes when the unit is run at operational loads.

The calculations provided in Appendix C show emission factors for unit Type A.1 and Type A.2, meant to represent the uncontrolled and controlled emission factors for the units with aftertreatment systems. These aftertreatment systems could be supplied by Miratech, Safety Power, or Caterpillar, and therefore the minimum control between the two for each pollutant is used.

[1] The maximum emission factor is at different load levels for different pollutants.

[2] Emission factors for SO_2 do not include fuel consumption or hp adjustment since emissions are unrelated to combustion reactions and are strictly determined by a sulfur balance. Further, these are only calculated at 85% load, when fuel consumption is the highest.

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Hazardous air pollutant emissions for the engines were calculated using emission factors for large diesel engines from AP-42 Tables 3.4-3 and 3.4-4, the diesel heating value of 128,730 Btu/gal, the engine fuel consumption, and the anticipated annual operating hours.

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5. PERMIT LIMIT

Amazon is requesting a facility-wide NO_X emission limit of 24.3 tpy for DEN-22. DEN-22 will keep records of each engine's monthly fuel use and calculate the twelve-month rolling total (12MRT) operating fuel use by summing the total fuel use for all engines for the previous 12 months to maintain compliance with the facility-wide NO_X limit. Fuel usage across all forty-five (45) emergency engines is limited by the facility-wide NO_X limit.

Compliance with the facility-wide annual emissions limit will be demonstrated by calculating the 12MRT emissions using the monthly fuel usage for each engine and the emission factors discussed in Section 4.1. The equation to calculate the 12MRT emissions is shown in Equation 5-1 below.

Amazon proposes that the total amount of fuel used shall be limited such that the resulting NOX emissions shall not exceed 24.3 tpy, annually on a 12MRT.

Equation 5-1. DEN-22 Total Emissions

$$\left(Pad\ 1\ engine\ EF\left(\frac{lb}{gal}\right) * Pad\ 1\ engine\ Fuel\ Use\left(\frac{gal}{yr}\right)\right) +$$
$$\left(Pad\ 2\ House\ engine\ EF\left(\frac{lb}{gal}\right) * Pad\ 2\ House\ engine\ Fuel\ Use\left(\frac{gal}{yr}\right)\right) +$$
$$\left((Pad\ 2\ engine\ Uncontrolled\ EF\left(\frac{lb}{gal}\right) * Pad\ 2\ engine\ Fuel\ Use\left(\frac{gal}{yr}\right)\right) +$$
$$\left((Pad\ 2\ engine\ Controlled\ EF\left(\frac{lb}{gal}\right) * Pad\ 2\ engine\ Fuel\ Use\left(\frac{gal}{yr}\right)\right)$$
$$* \left(\frac{1\ ton}{2000\ lb}\right) = Total\ Emissions\ (tpy)$$

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6. REGULATORY APPLICABILITY ANALYSIS

6.1 New Source Performance Standards

NSPS, located in 40 CFR 60, require new, modified, or reconstructed sources to control emissions to the level achievable by the best demonstrated technology as specified in the applicable provisions. The following is a summary of applicability determinations for NSPS regulations of relevance to the proposed project. Rules that are specific to certain source categories unrelated to the proposed project are not discussed in this regulatory review.

6.1.1 40 CFR 60 Subpart A – General Provisions

All affected sources subject to source-specific NSPS are subject to the general provisions of NSPS Subpart A unless specifically excluded by the source-specific NSPS. Subpart A requires initial notification, performance testing, recordkeeping and monitoring, provides reference methods, and mandates general control device requirements for all other subparts as applicable.

6.1.2 40 CFR 60 Subpart IIII – Stationary Compression Ignition Internal Combustion Engines

NSPS Subpart IIII, *Standards of Performance for Stationary Compression Ignition Internal Combustion Engines*, applies to owners and operators of stationary compression ignition (CI) internal combustion engines (ICE) that commenced construction after July 11, 2005, where the stationary CI ICE are manufactured after April 1, 2006, and are not fire pump engines, or manufactured as a certified National Fire Protection Association (NFPA) fire pump engine after July 1, 2006. This subpart also applies to owners and operators of any stationary CI ICE that are modified or reconstructed after July 11, 2005.[3]

The emergency generator engines are not fire pump engines and commenced construction after July 11, 2005 and will all have a manufacture date after April 1, 2006. Therefore, the requirements of NSPS Subpart IIII apply to the engines at DEN-22. Amazon will comply with the applicable emission standards and compliance requirements for the emergency generator engines.

6.2 National Emission Standards for Hazardous Air Pollutants

NESHAP, located in 40 CFR 61 and 40 CFR 63, have been promulgated for source categories that emit HAP to the atmosphere. A facility that is a major source of HAP is defined as having potential emissions of greater than 25 tpy of total HAP and/or 10 tpy of individual HAP. Facilities with a potential to emit HAP at an amount less than that which is defined as a major source are otherwise considered an area source. The NESHAP allowable emissions limits are most often established on the basis of a maximum achievable control technology (MACT) determination for the particular major source. The NESHAP apply to sources in specifically regulated industrial source categories (Clean Air Act Section 112(d)) or on a case-by-case basis (Section 112(g)) for facilities not regulated as a specific industrial source type.

DEN-22 is classified as an area source of HAP emissions. Detailed emission calculations demonstrating the current potential HAP emissions are included in Appendix C.

[3] 40 CFR 60.4200(a)

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The determination of applicability to NESHAP requirements for the proposed project is detailed in the following sections. Rules that are specific to certain source categories unrelated to the proposed project are not discussed in this regulatory review.

6.2.1 40 CFR 63 Subpart A – General Provisions

NESHAP Subpart A, General Provisions, contains national emission standards for HAP defined in Section 112(b) of the Clean Air Act. All affected sources, which are subject to another NESHAP in 40 CFR 63, are subject to the general provisions of NESHAP Subpart A, unless specifically excluded by the source-specific NESHAP.

6.2.2 40 CFR 63 Subpart ZZZZ – Stationary Reciprocating Internal Combustion Engines

NESHAP Subpart ZZZZ, *NESHAP for Stationary Reciprocating Internal Combustion Engines*, establishes emission and operating limits for stationary reciprocating internal combustion engines (RICE) located at a major or area source of HAP emissions.[4] As an area source of HAP, NESHAP Subpart ZZZZ applies to the emergency generator engines.

Per 40 CFR 63.6590(c)(1), a new or reconstructed stationary RICE located at an area source must meet the requirements of NESHAP Subpart ZZZZ by meeting the requirements of NSPS Subpart IIII. The emergency generator engines qualify as new stationary RICE under this subpart because they commenced construction on or after June 12, 2006, at an area source of HAP emissions.[5] Therefore, Amazon will comply with the requirements of NESHAP Subpart ZZZZ by meeting the requirements of NSPS Subpart IIII.

6.2.3 Non-Applicability of All Other NESHAP

NESHAP are developed for specific industrial source categories. The applicability of a particular NESHAP to the proposed project can be readily ascertained based on the industrial source category covered. All other NESHAP are categorically not applicable to the proposed projects.

6.3 State Regulatory Requirements

DEN-22 will be subject to several Colorado Air Quality Control Commission Regulations, including the following:

- Regulation No. 1, Section II.A.2. & 4. – Opacity limits for intermittent sources and periods of startup, modifications, or adjustment of control equipment
- Regulation No. 1, Section III.A.1. – Particulate matter emissions requirements for fuel burning equipment
- Regulation No. 1, Section VI.B.4. – Sulfur dioxide emission limits
- Regulation No. 2, Part A – Odor Provisions
- Regulation No. 3, Part A, Section II.C – Revised Air Pollutant Emission Notices (APENs)
- Regulation No. 3, Part B, Section II.A.4. – Construction permit potential emissions
- Regulation No. 3, Part B, Section III.B.5. – Environmental Justice Summary

[4] 40 CFR 63.6585

[5] 40 CFR 63.6590(a)(2)(iii)

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- Details pertaining to Regulation No. 3 Environmental Justice summary requirements are included in Appendix D.

- Regulation No. 3, Part B, Section III.D.2 – RACT Requirements for new Minor Sources – Discussed further in Section below.
- Regulation No. 3, Part B, Section III.G. – Final permit approval
- Regulation No. 6, Part A – Standards of performance for new stationary sources
- Regulation No. 6, Part B Section II.C & D. – Standards for particulate matter and sulfur dioxide for new fuel-burning equipment
- Regulation No. 26, Part B Section I. – Control of Emissions from Engines [6]

6.3.1 Regulation No. 3, Part B, Section III.D.2. – RACT Requirements

Per regulation No. 3, Part B, Section III.D.2, minor sources in designated non-attainment areas that are otherwise not exempt pursuant to Section II.D. of this Part, shall apply Reasonably Available Control Technology (RACT) for the pollutants for which the area is non-attainment. The Denver Metro North Front Range (DMNFR) is designated as a severe Ozone non-attainment area. NO_X and VOC are the regulated precursor pollutants to Ozone.

Since the units are emergency generators that will operate intermittently, RACT is expected to be NSPS IIII tier certification requirements.

[6] Although Regulation 26 is applicable to diesel engines > 500 HP, as long as Amazon maintains the engines for emergency purposes only per Regulation 26, Part B, Section I.D.6.a.(vi)(D), the units will be exempt from the requirements of this Regulation.

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7. MODELING APPLICABILITY

Appendix B of this application includes a copy of the CDPHE required Facility and Project Information Submittal Form for Modeling Requirements Determination (Form APCD-114). A modeling analysis is being submitted under separate cover.

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APPENDIX A. APEN FORMS AND FEES

This section contains APEN Forms for the following unit:

- AIRS ID 001: DEN-22 Emergency Generators

Amazon has paid the APEN filing fees for the amount of $363 electronically via CDPHE's online payment portal.

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APPENDIX B. MODELING DETERMINATION (FORM APCD-114)

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Facility and Project Information Submittal Form for Modeling Requirements Determination Form APCD-114

Please answer all questions on this form. If requested information does not apply to your project, insert "N/A." Form completion and submission of all associated documentation is required to obtain a Dispersion Modeling Unit (DMU) Determination. This Determination must describe and include all substantially related changes to the source that are being made as part of the modification(s) leading to this permit action, even if those changes are being, or have been, submitted under a separate application, and even if those changes are not being permitted as part of this permit action. All information submitted to obtain this modeling determination must be the same as that submitted to the Division's permitting staff in support of the permit application, including, but not limited to, requested emission limitations, requested annual operating hours, facility configuration, and stack characteristics provided on the Air Pollutant Emissions Notice (APEN). Any changes to this information can result in the need for a new modeling determination.

1) Date: 08/12/2025

2) Company Name: Amazon Data Services, Inc.

3) Company Contact Information

   Name: Jack Peterson

   Email: jack.peterson@trinityconsultants.com

   Phone Number: (970) 372-9337

4) Applicant Contact Information (if different than company contact)

   Name: _____

   Email: _____

   Phone Number: _____

5) Facility Name: DEN-22

6) Is this a new facility or a modification to an existing facility? New Facility ☐ Modification ☒

   Please provide location (LAT/LONG): 39.7210870 / -104.7572780

7) Describe the existing modified and new emission points (including APEN- and permit-exempt sources), AIRS ID number, and location (LAT/LONG):

Description	AIRS ID Number	LAT/LONG or UTM
DEN-22 Campus	005-1722-XXX	39.7210870 / -104.7572780

8) Provide a detailed description of all changes to the source that are "substantially related" as that term is defined in EPA's "Prevention of Significant Deterioration (PSD) and Nonattainment New Source Review (NSR): Aggregation and Project Netting" 74 Fed. Reg. 2376, 2377 (January 15, 2009) and EPA's 2018 Reinstatement Rule, 83 Fed. Reg. 57324 (Nov. 15, 2018) (Units moving? Operational changes?). Please identify which of the substantially related changes are part of the current permit action, and which may have been separately permitted.

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Amazon will be requesting a synthetic minor limit for the Den-22 Campus (Construction Permit 19AR0178, Facility AIRS ID 005-1722), including the currently permitted Pad 1 (18 emergency diesel generators) and the proposed Pad 2 (26 emergency diesel generators and 1 house diesel generator). Currently, the existing engines at Pad 1 are permitted under 19AR0178, Issuance 3. As part of this expansion of the DEN-22 Campus, the new engines proposed for Pad 2, which will be equipped with SCR, will trigger a permit modification, and Amazon will be requesting a facility-wide federally enforceable permit limit to remain a synthetic minor source.

Environmental Justice Requirements

The Environmental Justice Report Tool for Regulation Number 3 is available on the Air Pollution Control Division's website: https://cdphe.colorado.gov/new-environmental-justice-report-tool-for-air-quality-regulation-3 Instructions for the tool are available in the tool's online user guide and frequently asked questions document,
both of which are available on the website above. Instructions on how to submit a required EJ Summary and Report are also available on the website above. If you have questions about the EJ Report process, please email: cdphe_apcd_ejreports@state.co.us.

Note: As part of the pre-permit process, you must submit your EJ Report and Summary to cdphe_apcd_ejreports@state.co.us at the same time that you submit this Form APCD 114.

☐ Check this box if your application was submitted prior to July 15, 2023, and is therefore not subject to these Environmental Justice requirements. If this is the case, you do not need to answer questions 7 and 8 below.

9) Based on the Environmental Justice Requirements, is this facility an Affected Construction Source? Yes ☐ No ☒

10) Based on the Environmental Justice Report generated by the tool, is this facility located in a Disproportionately Impacted (DI) Community or a Socioeconomically Vunerable (SV) Community? (**Note:** Check both if the facility is located in a CI community and a SV community. Yes ☒ No ☐

CI ☐ SV ☒

11) If the proposed project includes a new General Permit Registration for GP01, GP02, GP05, GP06, GP07, GP08, GP09, GP10, and/or GP11 coverage, please identify the applicable General Permit for each applicable Source ID:

Source ID	General Permit Number
005-1722-XXX	

12) Is the proposed permitting action a conversion of a GP09 or GP10 to a construction permit? Yes ☐ No ☒

If yes, when was the original GP09 or GP10 registration request submitted to the Division?

Docusign Envelope ID: 9C8EC8DC-4C18-4394-A74F-E7CCFDDA6B5F

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13) Please provide a topographical or an aerial map with the new or modified emissions point(s), structures, and site boundary shown (Attached).

14) Attach facility criteria pollutant (NOX, SO2, CO, PM10, PM2.5, and Pb) permitted emissions for permitted units and potential to emit (PTE) emission estimates from all insignificant activities for all new and modified emission units, as well as facility totals. Include fugitive and APEN- and permit-exempt emission units. (Submitted via the customer portal).

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Equipment ID	Annual Emission Rate (tpy)						Hourly Emission Rate (lb/hr)			Daily Emission Rate (lb/day)		3-month Rolling Average Emission Rate (lb/3 months)
	CO	NOx	SO2	PM10	PM2.5	Pb	CO	NOx	SO2	PM10	PM2.5	Pb
Existing												
B060_005	0.266666667	1.35	0.205555556	0.094444444	0.094444444	0	10.063	51.1825	7.8075	0.517503805	0.517503805	
B061_005	0.266666667	1.35	0.205555556	0.094444444	0.094444444	0	10.063	51.1825	7.8075	0.517503805	0.517503805	
B062_005	0.266666667	1.35	0.205555556	0.094444444	0.094444444	0	10.063	51.1825	7.8075	0.517503805	0.517503805	
B060_CE2	0.266666667	1.35	0.205555556	0.094444444	0.094444444	0	10.063	51.1825	7.8075	0.517503805	0.517503805	
B062_001	0.266666667	1.35	0.205555556	0.094444444	0.094444444	0	10.063	51.1825	7.8075	0.517503805	0.517503805	
B061_001	0.266666667	1.35	0.205555556	0.094444444	0.094444444	0	10.063	51.1825	7.8075	0.517503805	0.517503805	
B061_002	0.266666667	1.35	0.205555556	0.094444444	0.094444444	0	10.063	51.1825	7.8075	0.517503805	0.517503805	
B062_002	0.266666667	1.35	0.205555556	0.094444444	0.094444444	0	10.063	51.1825	7.8075	0.517503805	0.517503805	
B062_003	0.266666667	1.35	0.205555556	0.094444444	0.094444444	0	10.063	51.1825	7.8075	0.517503805	0.517503805	
B062_004	0.266666667	1.35	0.205555556	0.094444444	0.094444444	0	10.063	51.1825	7.8075	0.517503805	0.517503805	
B060_004	0.266666667	1.35	0.205555556	0.094444444	0.094444444	0	10.063	51.1825	7.8075	0.517503805	0.517503805	
B061_004	0.266666667	1.35	0.205555556	0.094444444	0.094444444	0	10.063	51.1825	7.8075	0.517503805	0.517503805	
B061_003	0.266666667	1.35	0.205555556	0.094444444	0.094444444	0	10.063	51.1825	7.8075	0.517503805	0.517503805	
B060_003	0.266666667	1.35	0.205555556	0.094444444	0.094444444	0	10.063	51.1825	7.8075	0.517503805	0.517503805	
B060_002	0.266666667	1.35	0.205555556	0.094444444	0.094444444	0	10.063	51.1825	7.8075	0.517503805	0.517503805	
B060_001	0.266666667	1.35	0.205555556	0.094444444	0.094444444	0	10.063	51.1825	7.8075	0.517503805	0.517503805	
B060_DE1	0.266666667	1.35	0.205555556	0.094444444	0.094444444	0	10.063	51.1825	7.8075	0.517503805	0.517503805	
B060_CE1	0.266666667	1.35	0.205555556	0.094444444	0.094444444	0	10.063	51.1825	7.8075	0.517503805	0.517503805	
B064_HSG	0	0	0	0	0	0	0	0	0	0	0	
B064_04A	0	0	0	0	0	0	0	0	0	0	0	
B064_04B	0	0	0	0	0	0	0	0	0	0	0	
B064_03A	0	0	0	0	0	0	0	0	0	0	0	
B064_03B	0	0	0	0	0	0	0	0	0	0	0	
B064_02A	0	0	0	0	0	0	0	0	0	0	0	
B064_02B	0	0	0	0	0	0	0	0	0	0	0	
B064_01A	0	0	0	0	0	0	0	0	0	0	0	
B064_01B	0	0	0	0	0	0	0	0	0	0	0	
B063_04A	0	0	0	0	0	0	0	0	0	0	0	
B063_04B	0	0	0	0	0	0	0	0	0	0	0	
B063_03A	0	0	0	0	0	0	0	0	0	0	0	
B063_03B	0	0	0	0	0	0	0	0	0	0	0	
B063_02A	0	0	0	0	0	0	0	0	0	0	0	
B063_02B	0	0	0	0	0	0	0	0	0	0	0	
B063_01A	0	0	0	0	0	0	0	0	0	0	0	

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B063_01B	0	0	0	0	0	0	0	0	0	0	0	
B063_21C	0	0	0	0	0	0	0	0	0	0	0	
B063_11C	0	0	0	0	0	0	0	0	0	0	0	
B065_01B	0	0	0	0	0	0	0	0	0	0	0	
B065_01A	0	0	0	0	0	0	0	0	0	0	0	
B065_02B	0	0	0	0	0	0	0	0	0	0	0	
B065_02A	0	0	0	0	0	0	0	0	0	0	0	
B065_03B	0	0	0	0	0	0	0	0	0	0	0	
B065_03A	0	0	0	0	0	0	0	0	0	0	0	
B065_04B	0	0	0	0	0	0	0	0	0	0	0	
B065_04A	0	0	0	0	0	0	0	0	0	0	0	
Point Sources												
OpenPit Sources												
Flares												
Area Sources												
Proposed												
B060_005	0.371790826	0.653167574	0.001	0.10220224	0.102	0	22.06834951	38.77	0.031	0.560012274	0.56	
B061_005	0.371790826	0.653167574	0.001	0.10220224	0.102	0	22.06834951	38.77	0.031	0.560012274	0.56	
B062_005	0.371790826	0.653167574	0.001	0.10220224	0.102	0	22.06834951	38.77	0.031	0.560012274	0.56	
B060_CE2	0.371790826	0.653167574	0.001	0.10220224	0.102	0	22.06834951	38.77	0.031	0.560012274	0.56	
B062_001	0.371790826	0.653167574	0.001	0.10220224	0.102	0	22.06834951	38.77	0.031	0.560012274	0.56	
B061_001	0.371790826	0.653167574	0.001	0.10220224	0.102	0	22.06834951	38.77	0.031	0.560012274	0.56	
B061_002	0.371790826	0.653167574	0.001	0.10220224	0.102	0	22.06834951	38.77	0.031	0.560012274	0.56	
B062_002	0.371790826	0.653167574	0.001	0.10220224	0.102	0	22.06834951	38.77	0.031	0.560012274	0.56	
B062_003	0.371790826	0.653167574	0.001	0.10220224	0.102	0	22.06834951	38.77	0.031	0.560012274	0.56	
B062_004	0.371790826	0.653167574	0.001	0.10220224	0.102	0	22.06834951	38.77	0.031	0.560012274	0.56	
B060_004	0.371790826	0.653167574	0.001	0.10220224	0.102	0	22.06834951	38.77	0.031	0.560012274	0.56	
B061_004	0.371790826	0.653167574	0.001	0.10220224	0.102	0	22.06834951	38.77	0.031	0.560012274	0.56	
B061_003	0.371790826	0.653167574	0.001	0.10220224	0.102	0	22.06834951	38.77	0.031	0.560012274	0.56	
B060_003	0.371790826	0.653167574	0.001	0.10220224	0.102	0	22.06834951	38.77	0.031	0.560012274	0.56	
B060_002	0.371790826	0.653167574	0.001	0.10220224	0.102	0	22.06834951	38.77	0.031	0.560012274	0.56	
B060_001	0.371790826	0.653167574	0.001	0.10220224	0.102	0	22.06834951	38.77	0.031	0.560012274	0.56	
B060_DE1	0.371790826	0.653167574	0.001	0.10220224	0.102	0	22.06834951	38.77	0.031	0.560012274	0.56	
B060_CE1	0.371790826	0.653167574	0.001	0.10220224	0.102	0	22.06834951	38.77	0.031	0.560012274	0.56	
B064_HSG	0.299077275	0.501710868	0	0.108273545	0.108	0	17.752299885	29.78	0.025	0.5932797	0.593	

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B064_04A	0.094770217	0.461510949	0.001	0.019214107	0.019	0	7.812869344	10.99632038	0.035	1.55576362	1.556	
B064_04B	0.094770217	0.461510949	0.001	0.019214107	0.019	0	7.812869344	10.99632038	0.035	1.55576362	1.556	
B064_03A	0.094770217	0.461510949	0.001	0.019214107	0.019	0	7.812869344	10.99632038	0.035	1.55576362	1.556	
B064_03B	0.094770217	0.461510949	0.001	0.019214107	0.019	0	7.812869344	10.99632038	0.035	1.55576362	1.556	
B064_02A	0.094770217	0.461510949	0.001	0.019214107	0.019	0	7.812869344	10.99632038	0.035	1.55576362	1.556	
B064_02B	0.094770217	0.461510949	0.001	0.019214107	0.019	0	7.812869344	10.99632038	0.035	1.55576362	1.556	
B064_01A	0.094770217	0.461510949	0.001	0.019214107	0.019	0	7.812869344	10.99632038	0.035	1.55576362	1.556	
B064_01B	0.094770217	0.461510949	0.001	0.019214107	0.019	0	7.812869344	10.99632038	0.035	1.55576362	1.556	
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B063_04B	0.094770217	0.461510949	0.001	0.019214107	0.019	0	7.812869344	10.99632038	0.035	1.55576362	1.556	
B063_03A	0.094770217	0.461510949	0.001	0.019214107	0.019	0	7.812869344	10.99632038	0.035	1.55576362	1.556	
B063_03B	0.094770217	0.461510949	0.001	0.019214107	0.019	0	7.812869344	10.99632038	0.035	1.55576362	1.556	
B063_02A	0.094770217	0.461510949	0.001	0.019214107	0.019	0	7.812869344	10.99632038	0.035	1.55576362	1.556	
B063_02B	0.094770217	0.461510949	0.001	0.019214107	0.019	0	7.812869344	10.99632038	0.035	1.55576362	1.556	
B063_01A	0.094770217	0.461510949	0.001	0.019214107	0.019	0	7.812869344	10.99632038	0.035	1.55576362	1.556	
B063_01B	0.094770217	0.461510949	0.001	0.019214107	0.019	0	7.812869344	10.99632038	0.035	1.55576362	1.556	
B063_21C	0.094770217	0.461510949	0.001	0.019214107	0.019	0	7.812869344	10.99632038	0.035	1.55576362	1.556	
B063_11C	0.094770217	0.461510949	0.001	0.019214107	0.019	0	7.812869344	10.99632038	0.035	1.55576362	1.556	
B065_01B	0.094770217	0.461510949	0.001	0.019214107	0.019	0	7.812869344	10.99632038	0.035	1.55576362	1.556	
B065_01A	0.094770217	0.461510949	0.001	0.019214107	0.019	0	7.812869344	10.99632038	0.035	1.55576362	1.556	
B065_02B	0.094770217	0.461510949	0.001	0.019214107	0.019	0	7.812869344	10.99632038	0.035	1.55576362	1.556	
B065_02A	0.094770217	0.461510949	0.001	0.019214107	0.019	0	7.812869344	10.99632038	0.035	1.55576362	1.556	
B065_03B	0.094770217	0.461510949	0.001	0.019214107	0.019	0	7.812869344	10.99632038	0.035	1.55576362	1.556	
B065_03A	0.094770217	0.461510949	0.001	0.019214107	0.019	0	7.812869344	10.99632038	0.035	1.55576362	1.556	
B065_04B	0.094770217	0.461510949	0.001	0.019214107	0.019	0	7.812869344	10.99632038	0.035	1.55576362	1.556	
B065_04A	0.094770217	0.461510949	0.001	0.019214107	0.019	0	7.812869344	10.99632038	0.035	1.55576362	1.556	
Point Sources												
OpenPit Sources												
Flares												
Area Sources												

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Change in Emissions												
Project Total	4.66	-0.04	-3.67	0.75	0.75	0	436.98	92.26	-139.04	41.81	41.81	0

If the source is subject to the Environmental Justice provisions, provide facility benzene, toluene, ethylbenzene, xylenes, and total BTEX as described above. (Submitted via the customer portal).

Please include Form APCD-102 or APCD-102a for the facility. (Attached).

15) Provide release parameters for each emission unit. (Submitted via the customer portal).

Point Sources (e.g. stacks and isolated vents) with a vertical release (not a flare)							
Equipment ID	Description of source	Location LAT/LONG or UTM	Source release height above ground (m)	Stack gas exit temperature (K)	Stack gas exit velocity (m/s)	Stack inside diameter (m)	Capped, J- tube, or Horizontal release?
B060_005	Pad 1 Emergency Generator - Permitted	39.721087 / -104.757278	4.67	729.317	53.17	0.4572	Vertical
B061_005	Pad 1 Emergency Generator - Permitted	39.721087 / -104.757278	11.89	729.317	53.17	0.4572	Vertical
B062_005	Pad 1 Emergency Generator - Permitted	39.721087 / -104.757278	11.89	729.317	53.17	0.4572	Vertical
B060_CE2	Pad 1 Emergency Generator - Existing	39.721087 / -104.757278	11.89	729.317	53.17	0.4572	Vertical
B062_001	Pad 1 Emergency Generator - Existing	39.721087 / -104.757278	11.89	729.317	53.17	0.4572	Vertical
B061_001	Pad 1 Emergency Generator - Existing	39.721087 / -104.757278	11.89	729.317	53.17	0.4572	Vertical
B061_002	Pad 1 Emergency Generator - Existing	39.721087 / -104.757278	11.89	729.317	53.17	0.4572	Vertical
B062_002	Pad 1 Emergency Generator - Existing	39.721087 / -104.757278	11.89	729.317	53.17	0.4572	Vertical
B062_003	Pad 1 Emergency Generator - Existing	39.721087 / -104.757278	11.89	729.317	53.17	0.4572	Vertical
B062_004	Pad 1 Emergency Generator - Existing	39.721087 / -104.757278	11.89	729.317	53.17	0.4572	Vertical
B060_004	Pad 1 Emergency Generator - Existing	39.721087 / -104.757278	4.67	729.317	53.17	0.4572	Vertical
B061_004	Pad 1 Emergency Generator - Existing	39.721087 / -104.757278	4.67	729.317	53.17	0.4572	Vertical
B061_003	Pad 1 Emergency Generator - Existing	39.721087 / -104.757278	4.67	729.317	53.17	0.4572	Vertical
B060_003	Pad 1 Emergency Generator - Existing	39.721087 / -104.757278	4.67	729.317	53.17	0.4572	Vertical
B060_002	Pad 1 Emergency Generator - Existing	39.721087 / -104.757278	4.67	729.317	53.17	0.4572	Vertical
B060_001	Pad 1 Emergency Generator - Existing	39.721087 / -104.757278	4.67	729.317	53.17	0.4572	Vertical
B060_DE1	Pad 1 Emergency Generator - Existing	39.721087 / -104.757278	4.67	729.317	53.17	0.4572	Vertical
B060_CE1	Pad 1 Emergency Generator - Existing	39.721087 / -104.757278	4.67	729.317	53.17	0.4572	Vertical
B064_HSG	Pad 2 House Generator - Proposed	39.721087 / -104.757278	13.41	673.206	72.672	0.3556	Vertical
B064_04A	Pad 2 Emergency Generator - Proposed	39.721087 / -104.757278	13.41	766.094	35.7066	0.6096	Vertical
B064_04B	Pad 2 Emergency Generator - Proposed	39.721087 / -104.757278	13.41	766.094	35.7066	0.6096	Vertical
B064_03A	Pad 2 Emergency Generator - Proposed	39.721087 / -104.757278	13.41	766.094	35.7066	0.6096	Vertical
B064_03B	Pad 2 Emergency Generator - Proposed	39.721087 / -104.757278	13.41	766.094	35.7066	0.6096	Vertical
B064_02A	Pad 2 Emergency Generator - Proposed	39.721087 / -104.757278	13.41	766.094	35.7066	0.6096	Vertical
B064_02B	Pad 2 Emergency Generator - Proposed	39.721087 / -104.757278	13.41	766.094	35.7066	0.6096	Vertical
B064_01A	Pad 2 Emergency Generator - Proposed	39.721087 / -104.757278	13.41	766.094	35.7066	0.6096	Vertical

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B064_01B	Pad 2 Emergency Generator - Proposed	39.721087 / -104.757278	13.41	766.094	35.7066	0.6096	Vertical
B063_04A	Pad 2 Emergency Generator - Proposed	39.721087 / -104.757278	13.41	766.094	35.7066	0.6096	Vertical
B063_04B	Pad 2 Emergency Generator - Proposed	39.721087 / -104.757278	13.41	766.094	35.7066	0.6096	Vertical
B063_03A	Pad 2 Emergency Generator - Proposed	39.721087 / -104.757278	13.41	766.094	35.7066	0.6096	Vertical
B063_03B	Pad 2 Emergency Generator - Proposed	39.721087 / -104.757278	13.41	766.094	35.7066	0.6096	Vertical
B063_02A	Pad 2 Emergency Generator - Proposed	39.721087 / -104.757278	13.41	766.094	35.7066	0.6096	Vertical
B063_02B	Pad 2 Emergency Generator - Proposed	39.721087 / -104.757278	13.41	766.094	35.7066	0.6096	Vertical
B063_01A	Pad 2 Emergency Generator - Proposed	39.721087 / -104.757278	13.41	766.094	35.7066	0.6096	Vertical
B063_01B	Pad 2 Emergency Generator - Proposed	39.721087 / -104.757278	13.41	766.094	35.7066	0.6096	Vertical
B063_21C	Pad 2 Emergency Generator - Proposed	39.721087 / -104.757278	13.41	766.094	35.7066	0.6096	Vertical
B063_11C	Pad 2 Emergency Generator - Proposed	39.721087 / -104.757278	13.41	766.094	35.7066	0.6096	Vertical
B065_01B	Pad 2 Emergency Generator - Proposed	39.721087 / -104.757278	13.41	766.094	35.7066	0.6096	Vertical
B065_01A	Pad 2 Emergency Generator - Proposed	39.721087 / -104.757278	13.41	766.094	35.7066	0.6096	Vertical
B065_02B	Pad 2 Emergency Generator - Proposed	39.721087 / -104.757278	13.41	766.094	35.7066	0.6096	Vertical
B065_02A	Pad 2 Emergency Generator - Proposed	39.721087 / -104.757278	13.41	766.094	35.7066	0.6096	Vertical
B065_03B	Pad 2 Emergency Generator - Proposed	39.721087 / -104.757278	13.41	766.094	35.7066	0.6096	Vertical
B065_03A	Pad 2 Emergency Generator - Proposed	39.721087 / -104.757278	13.41	766.094	35.7066	0.6096	Vertical
B065_04B	Pad 2 Emergency Generator - Proposed	39.721087 / -104.757278	13.41	766.094	35.7066	0.6096	Vertical
B065_04A	Pad 2 Emergency Generator - Proposed	39.721087 / -104.757278	13.41	766.094	35.7066	0.6096	Vertical

Flares						
Equipment ID	Description of source	Location LAT/LONG or UTM	Effective Stack Height	Stack gas exit temperature	Stack gas exit velocity	Effective Stack inside Diameter
			Value (m)	Value (K)	Value (m/s)	Value (m)
		/				

Calculate the effective stack parameters for flares as discussed in the AERSCREEN User's Guide. For ECDs provide source release height and stack inside diameter.

Volume Sources (releases at an elevation e.g. multiple vents, conveyor belts)					
Equipment ID	Description of source	Location LAT/LONG or UTM	Release height	Initial lateral dimension σ_y	Initial vertical dimension σ_z
			Value (m)	Value (m)	Value (m)
		/			

Use procedures in Table 3-3 of the AERMOD User's Guide to calculate vertical and lateral dimensions.

Area Sources (low level releases e.g. storage piles, slag dumps, lagoons)					
Equipment ID	Description of source	Location LAT/LONG or UTM	Release height	Length of side X- and Y-dimension	Initial vertical dimension σ_z
			Value (m)	Values (m)	Value (m)
		/			

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Use this table to include Areacircle and Areapoly sources as well.

Openpit Sources					
Equipment ID	Description of source	Location LAT/LONG or UTM	Release height above base of pit	Length of side X- and Y-dimension	Pit Volume
			Value (m)	Values (m)	Value (m^3)
		/			

16) Please provide the source's operating schedule:

Daily starting and ending hours (e.g. 7 AM – 5 PM): 24 hours

Days of the week (e.g. Monday – Friday): 7 days a week

17) If emissions points are located adjacent to buildings or other structures, please provide structure dimensions.

Building Description	Height (m)	Length (m)	Width(m)

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18) Has this facility been modeled before? Yes ☐ No ☒

If yes, provide any records of previous modeling demonstrations that the facility will not cause or contribute to a violation of the NAAQS.

19) If you do not believe modeling should be required for the proposed permitting action, please provide clear justification for this, along with the information requested above.

Amazon Data Services, Inc. believes modeling should not be required since the facility only has intermittent sources. Each engine is only operated for maintenance and testing purposes for ~34 hours/year/engine.

20) Has a permit application already been submitted for this facility and still awaiting permit approval? Yes ☐ No ☒

If yes, when was the application submitted? _____

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1) Modeling determination identification number: MD-00605
2) Existing Source Facility ID and AIRS number: DEN-22 005-1722

3) Is the proposed facility located in a Cumulatively Impacted Community?

Yes ☐ No ☒ N/A ☐

4) Based on the application information submitted, is modeling required to determine source-specific monitoring requirements?

Yes ☐ No ☒ N/A ☐

5) Based on the application information submitted, is modeling needed to complete the required NAAQS analysis?

Yes ☒ No ☐

6) Justification for Modeling Determination (e.g., previous NAAQS modeling demonstration has been made):

The facility is not located in a Cumulatively Impacted Community, therefore additional modeling under AQCC Regulation 3 Part B III.B.4 is not required.

As part of the prior permitting action for this source, the Division made a determination this source will not cause an exceedance of any National Ambient Air Quality Standards ("NAAQS") as required by Colorado Air Quality Control Commission Regulation 3, Part B. The Division is not reconsidering that prior determination. In every permitting action, however, the Division must conduct a NAAQS analysis regarding whether the proposed source or activity which is the basis of the new permit application will cause an exceedance of the NAAQS. Depending on several variables, modeling may be required in some cases to conduct the required NAAQS analysis. However, requiring modeling solely because modeling was not previously used to conduct the required NAAQS analysis is not justified. This permitting action must be evaluated on its own merit and site-specific/case-specific facts.

In this current permit application, Amazon Data Services Inc. is requesting to add 26 emergency generators and one house generator and decrease emissions from the existing generators at the existing DEN-22 facility. The proposed modification is represented to result in emissions increases of 0.75 tpy (41.81 lbs/day) PM10/PM2.5, 92.26 lbs/hour NOx and 4.66 tpy (436.98 lbs/hour) CO and emissions decreases of 0.04 tpy NOx and 3.67 tpy (139.04 lbs/hour) SO2. The proposed emission rate increases of long term PM2.5 and short term PM10 are below the corresponding threshold in Table 1 of the Colorado Minor NSR Source Modeling Guideline for Air Quality Permits (March 2025). The threshold amounts in Table 1 are considered de minimis emissions, which have a low probability of causing or

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contributing to an exceedance of any NAAQS. The proposed emission rate increases of short term NOx, PM2.5 and CO are all above the thresholds in Table 1 of the Colorado Minor NSR Source Modeling Guideline for Air Quality Permits (March 2025). A review of nearby sources shows high potential nearby NOx impacts associated with the location of the facility (Arapahoe County) within the ozone nonattainment area identified for the 2008 and 2015 ozone standard. Although the proposed units have good dispersion, the nearby sources are potentially significant and the emissions increases are well above the modeling thresholds. Therefore, the Division is requesting that dispersion modeling be submitted to demonstrate compliance with the 1-hour NO2 NAAQS, 24-hour PM2.5 NAAQS, 1-hour CO NAAQS and 8-hour CO NAAQS.

7) If modeling is required, which criteria pollutants and averaging periods need to be modeled to demonstrate compliance with the National Ambient Air Quality Standards and Colorado Ambient Air Quality Standards?

☐ N/A

☒ 1-Hour NO2 ☐ Annual NO2

☒ 1-hour CO ☒ 8-hour CO

☐ 1-hour SO2 ☐ 3-hour SO2 ☐ Annual SO2

☐ 24-hour PM10 ☒ 24-hour PM2.5 ☐ Annual PM2.5

☐ 3-month PB

8) If BTEX modeling is required, which pollutants need to be modeled to determine applicability to the Source Specific Monitoring Thresholds?

N/A

9) If modeling is needed, provide modeling procedure guidance.

Modeling should be completed based on the guidance provided at: https://cdphe.colorado.gov/emissions-from-business-and-industry/air-quality-modeling-guidance-for-permits#comod

10) Date modeling decision provided to Applicant and CDPHE Permitting Representative:

08/13/2025

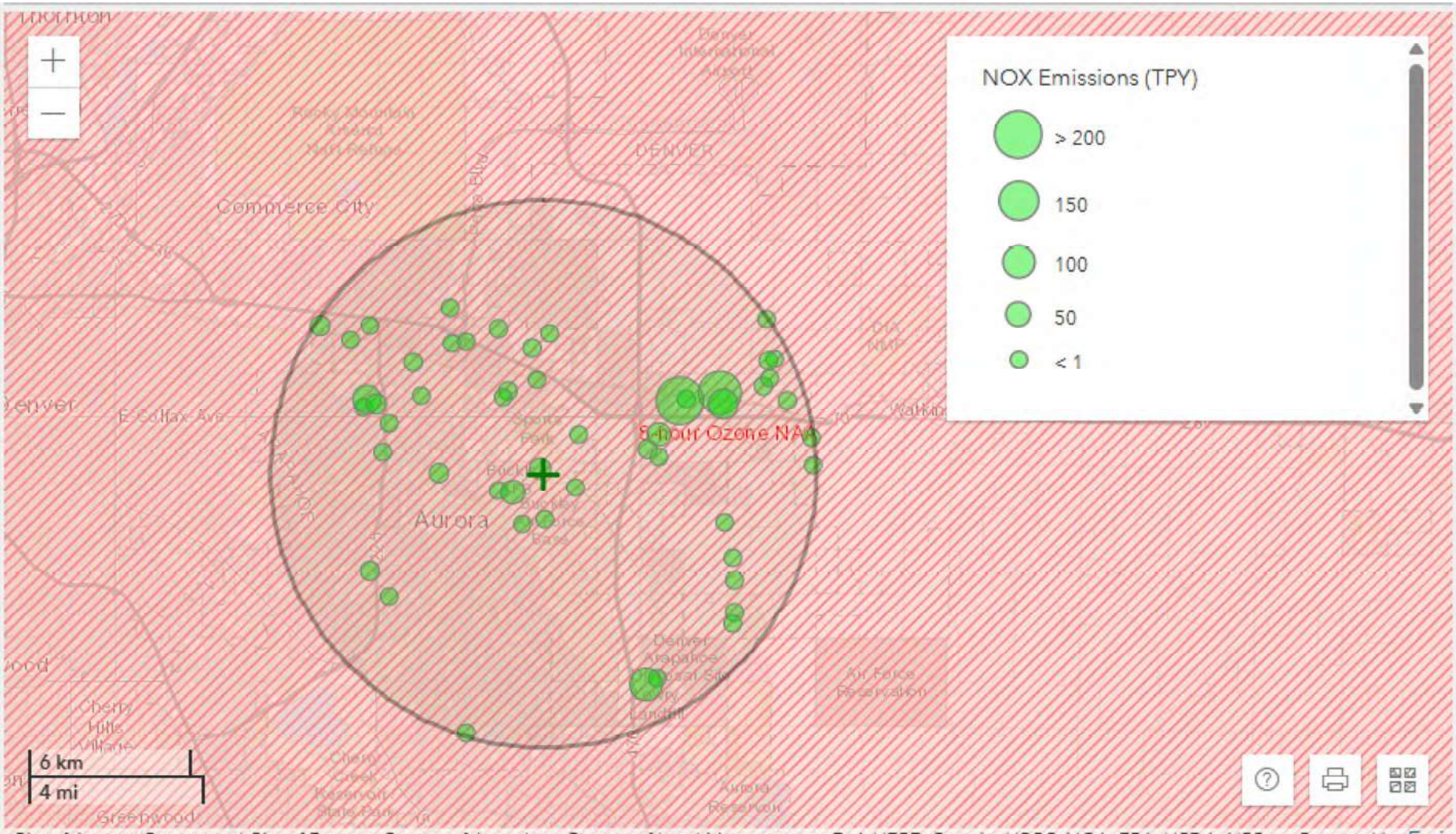
11) Number of hours spent on modeling determination:
1

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Ozone 8-hr NAA (2015 NAAQS): ☑ Ozone 8-hr NAA (2008 NAAQS): ☑ Ozone 1-hr AMA: ☐

PM10 AMA: ☐ CO AMA: ☐ Tribal land: ☐

Mandatory class 1 Federal areas: ☐

This map returns an inventory of stationary sources of air pollution based on origin coordinates, radius, and pollutant. To learn more about using this product, and other features of this product, click the help [?] icon on the lower right corner of the map.

Query at Longitude -104.7573 and Latitude 39.7211 for NOX sources within a 10(km) radius with emissions >0(TPY) returned:
52 sources; 919.863(TPY) total emissions

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Form APCD-102a

Colorado Department of Public Health and Environment
Air Pollution Control Division

Facility Wide Emissions Inventory Form

Ver. September, 2019

Company Name: Amazon Data Services, Inc.
Source Name: DEN-22
Source AIRS ID: 005-1722

			Uncontrolled Potential to Emit (PTE)															Controlled Potential to Emit (PTE)													
			Criteria (TPY)									HAPs (lbs/yr)						Criteria (TPY)									HAPs (lbs/yr)					
AIRS ID	Permit No.	Description	TSP	PM10	PM2.5	FUG. TSP	FUG. PM10	FUG PM2.5	SO2	NOx	VOC	CO	Benzene	Toluene	EB	Xylene	n-Hex	HCHO	TSP	PM10	PM2.5	FUG. TSP	FUG. PM10	FUG PM2.5	SO2	NOx	VOC	CO	Benzene	Toluene	EB	Xylene	n-Hex	HCHO
TBD	TBD	Type C Generators	1.84	1.84	1.84	0.00	0.00	0.00	0.01	11.76	1.39	6.69	8.94	3.24	0.00	2.22	0.00	0.91	1.84	1.84	1.84	0.00	0.00	0.00	0.01	11.76	1.39	6.69	8.94	3.24	0.00	2.22	0.00	0.91
TBD	TBD	Type B Generator	0.11	0.11	0.11	0.00	0.00	0.00	0.00	0.50	0.07	0.30	0.39	0.14	0.00	0.10	0.00	0.04	0.11	0.11	0.11	0.00	0.00	0.00	0.00	0.50	0.07	0.30	0.39	0.14	0.00	0.10	0.00	0.04
TBD	TBD	Type A Generators	1.59	1.59	1.59	0.00	0.00	0.00	0.02	20.42	1.09	8.21	14.34	5.19	0.00	3.57	0.00	1.46	0.50	0.50	0.50	0.00	0.00	0.00	0.02	12.00	0.66	2.46	14.34	5.19	0.00	3.57	0.00	0.44
		Permitted Sources Subtotal =	**3.5**	**3.5**	**3.5**	**0.0**	**0.0**	**0.0**	**0.03**	**32.7**	**2.6**	**15.2**	**23.7**	**8.6**	**0.0**	**5.9**	**0.0**	**2.4**	**2.4**	**2.4**	**2.4**	**0.0**	**0.0**	**0.0**	**0.03**	**24.3**	**2.1**	**9.5**	**23.7**	**8.6**	**0.0**	**5.9**	**0.0**	**1.4**
APEN Exempt / Insignificant Sources																																		
		Insignificant Subtotal =	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
		Total, All Sources =	**3.5**	**3.5**	**3.5**	**0.0**	**0.0**	**0.0**	**0.0**	**32.7**	**2.6**	**15.2**	**23.7**	**8.6**	**0.0**	**5.9**	**0.0**	**2.4**	**2.4**	**2.4**	**2.4**	**0.0**	**0.0**	**0.0**	**0.0**	**24.3**	**2.1**	**9.5**	**23.7**	**8.6**	**0.0**	**5.9**	**0.0**	**1.4**

												Uncontrolled HAPs Summary (TPY) =	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**											**Controlled HAPs Summary (TPY) =**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
												Uncontrolled Total, All HAPs (TPY) =	**0.0**																**Controlled Total, All HAPs (TPY) =**	**0.0**					

Footnotes:

1. This form should be completed to include both existing sources and all proposed new or modifications to existing emissions sources
2. If the emissions source is new then enter "proposed" under the Permit No. and AIRS ID data columns
3. Add and/or replace HAPS and other Non-Criteria Reportable Pollutants as necessary. HAP abbreviations include:
   EB = Ethylbenzene
   HCHO = Formaldehyde
   224-TMP = 2,2,4-Trimethylpentane
   Acetal = Acetaldehyde
   Acro = Acrolein
   n-Hex = n-Hexane
   Meth = Methanol
4. APEN Exempt/Insignificant Sources should be included when warranted.

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APPENDIX C. PROJECT EMISSION CALCULATIONS

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Generator Emission Calculation Inputs

Generator Count

Type [1]	Gen Use	Make	Size (kW)	EPA Tier Rating	Quantity
Type A.1	Pad 2 Gens_Uncontrolled	CAT 3516E_Uncontrolled	2,750	4 Uncontrolled	26
Type A.2	Pad 2 Gens_Controlled	CAT3516E_Controlled	2,750	4 Controlled	26
Type B	Pad 2 House	CAT 3516C	2,000	2	1
Type C	Pad 1 Gens	CAT 3516C	2,500	2	18
		Facility Total	**118,500**	**--**	**45**

[1] Type A.1 and A.2 represent the same generators. Type A.1 utilizes generator data from uncontrolled operations while Type A.2 utilizes data from controlled operations.

Facility NOx Emission Rate Design Limits

Scenario	NOx Emission Rate (tpy)
Non-emergency	24.3
Emergency & Non-Emergency	24.3

Operating Hours per Generator

Operating Scenario [1]	Tier 2/3 Generator Operation Time (hrs/yr/gen)	Tier 4 Generator Uncontrolled NO_X Operation Time (hrs/yr/gen)	Tier 4 Generator Controlled NO_X Operation Time (hrs/yr/gen)	Operational Load
Confidence Testing	2.60	2.60	--	0-10%
Preventative Maintenance Testing	0.33	0.33	--	0-10%
Annual Live Load Testing	0.50	0.25	0.25	40-85%
Load Bank Testing	0.70	0.50	0.20	Varied Loads 0-85%
Average Other [2]	2.90	2.80	0.10	0-85%
Total T&M Hours	**7.03**	**6.49**	**0.55**	**hr/yr/gen**
All Operating Hours [3]	**33.69**	**18.54**	**15.16**	**hr/yr/gen**
Total Startups	30	30	--	cold starts per year
Assumption for Tier 4 Generators (1 hr of operation)	--	10.00	50.00	minutes in 1 hour of operation

[1] Operating scenarios are as follows:

Confidence Testing: 6 minutes for each generator, performed at 0% load every other week for all units. For Tier 4 units, NOx is uncontrolled for the duration of the test.

Preventative Maintenance Testing: 10 minutes for each generator, performed at 0% load twice a year for all units.

Annual Live Load Testing: 30 minutes once a year, performed at various loads up to 90% for all Tier 2/3 units. For Tier 4 units, NOx is controlled after the first 15 minutes of the test.

Load Bank Testing: 42 minutes at varied loads, performed once a year for all units. For Tier 4 units, NOx is controlled after the first 30 minutes of the test.

[2] "Average Other" times for each generator category are used as a representation of the desired operational flexibility for these generators. ADS intends to track emergency and non-emergency operating hours for each generator, maintaining the ability to track compliance with an emissions limit without requiring a fuel throughput or hours limit on each generator. The representative operating scenarios provided in this table demonstrate the ability for ADS to maintain compliance with both the proposed PSELs and NSPS limits on emergency generator operations. Actual operations are expected to vary.

SO_2 Emission Factor Calculation

ULSD Sulfur Content	0.0015	percent
Fuel Density	7.09	lb/gallon

Greenhouse Gas Inputs

Diesel High Heat Value	0.138	MMBtu/gal

Pollutant	Distillate Fuel Oil No. 2 Emission Factors		GWP
CO_2	73.96	kg/MMBtu	1
N_2O	0.0006	kg/MMBtu	265
CH_4	0.003	kg/MMBtu	28

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Generator Emission Calculation Inputs

Type	Quantity	*Gen Use* Gen Use	*Make* Make	Size *Size* (kW)	*Tier*	Fuel Use (gal/hr)[2] *FUL_0.8:* 85%	*FUL_0.8* 80%	*FUL_0.75* 75%	*FUL_0.5* 50%	*FUL_0.3* 30%	*FUL_0.25* 25%	*FUL_0.1* 10%
Type A.1	26	Pad 2 Gens_Uncontrolled	CAT 3516E_Uncontrolled	2,750	4 Uncontrolled	163.90	155.60	147.30	107.50	71.80	62.90	36.10
Type A.2	26	Pad 2 Gens_Controlled	CAT3516E_Controlled	2,750	4 Controlled	163.90	155.60	147.30	107.50	71.80	62.90	36.10
Type B	1	Pad 2 House	CAT 3516C	2,000	2	117.30	111.60	106.10	76.50	50.20	44.20	26.10
Type C	18	Pad 1 Gens	CAT 3516C	2,500	2	147.60	140.40	133.20	97.10	65.30	57.20	30.90

[1] Small generator emission factors provided by the manufacturer in grams/kW-hr. Emission factors and fuel use at 100% load provided and utilized to determine the emission rates used in this evaluation.

[2] The manufacturers' information includes emissions rates (expressed in lbs/hr) for a range of generator loads for all engine types used at the facility. The emission rates and fuel use values shown here are not to be exceeded per the manufacturer's specifications based on the generator rated speed with potential site variation.

[3] PM/PM10/PM2.5 emission rates for all units are obtained from the manufacturer's PM + HC data in order to represent both filterable and condensable PM in the generator emission estimates.

[4] Dispersion parameters provided by the manufacturer.

[5] Type A.1 and A.2 represent the same generators. Type A.1 utilizes generator data from uncontrolled operations while Type A.2 utilizes data from controlled operations. Aftertreatment systems for the Tier 2 compliant 2,750 kW units can either be supplied by either Miratech or Safety Power. The minimum control efficiency between the two manufacturers for each pollutant will be used. Control efficiencies are found below:

Pollutant	Miratech	Safety Power
NOx	91.7%	91.7%
DPM	68.6%	75.6%
NMHC	50%	40%
CO	70%	80%

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Generator Emission Calculation Inputs

Type	Quantity	*Gen Use* Gen Use	*Make* Make	Size *Size* (kW)	*Tier*	NO_x Emission Rate (lb/hr)[2,5] *NOx_0.8:* 85%	*NOx_0.75* 75%	*NOx_0.5* 50%	*NOx_0.25* 25%	*NOx_0.1* 10%	CO Emission Rate (lb/hr)[2,5] *CO_0.85* 85%	*CO_0.75* 75%	*CO_0.5* 50%	*CO_0.25* 25%	*CO_0.1* 10%
Type A.1	26	Pad 2 Gens_Uncontrolled	CAT 3516E_Uncontrolled	2,750	4 Uncontrolled	41.10	32.44	16.79	9.27	10.27	4.54	3.74	2.62	4.17	4.13
Type A.2	26	Pad 2 Gens_Controlled	CAT3516E_Controlled	2,750	4 Controlled	3.41	2.69	1.39	0.77	0.85	1.36	1.12	0.79	1.25	1.24
Type B	1	Pad 2 House	CAT 3516C	2,000	2	29.78	22.75	12.81	9.31	6.47	2.41	1.88	1.97	3.91	3.95
Type C	18	Pad 1 Gens	CAT 3516C	2,500	2	38.77	31.09	15.44	7.87	7.02	3.45	2.88	2.41	3.30	4.62

[1] Small generator emission factors provided by the manufacturer in grams/kW-hr. Emission factors and fuel use at 100% load provided and utilized to determine the emission rates used in this evaluation.

[2] The manufacturers' information includes emissions rates (expressed in lbs/hr) for a range of generator loads for all engine types used at the facility. The emission rates and fuel use values shown here are not to be exceeded per the manufacturer's specifications based on the generator rated speed with potential site variation.

[3] PM/PM10/PM2.5 emission rates for all units are obtained from the manufacturer's PM + HC data in order to represent both filterable and condensable PM in the generator emission estimates.

[4] Dispersion parameters provided by the manufacturer.

[5] Type A.1 and A.2 represent the same generators. Type A.1 utilizes generator data from uncontrolled operations while Type A.2 utilizes data from controlled operations. Aftertreatment systems for the Tier 2 compliant 2,750 kW units can either be supplied by either Miratech or Safety Power. The minimum control efficiency between the two manufacturers for each pollutant will be used. Control efficiencies are found below:

Pollutant	Miratech	Safety Power
NOx	91.7%	91.7%
DPM	68.6%	75.6%
NMHC	50%	40%
CO	70%	80%

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Generator Emission Calculation Inputs

Type	Quantity	*Gen Use* Gen Use	*Make* Make	Size *Size* (kW)	*Tier*	VOC Emission Rate (lb/hr)[2,5] *VOC_0.85* 85%	*VOC_0.75* 75%	*VOC_0.5* 50%	*VOC_0.25* 25%	*VOC_0.1* 10%	Manufacturer's PM Emission Rate (lb/hr)[2,3,5] *PM_0.85* 85%	*PM_0.75* 75%	*PM_0.5* 50%	*PM_0.25* 25%	*PM_0.1* 10%	Source Type *SRCTP*	Height[4] *HGT* ft	Diameter[4] *DIA* in
Type A.1	26	Pad 2 Gens_Uncontrolled	CAT 3516E_Uncontrolled	2,750	4 Uncontrolled	0.85	0.84	0.78	0.71	0.55	0.55	0.51	0.46	0.44	0.29	POINT	44.00	24.00
Type A.2	26	Pad 2 Gens_Controlled	CAT3516E_Controlled	2,750	4 Controlled	0.51	0.50	0.47	0.43	0.33	0.17	0.16	0.14	0.14	0.09	POINT	44.00	24.00
Type B	1	Pad 2 House	CAT 3516C	2,000	2	1.16	1.13	1.13	0.90	0.98	0.34	0.33	0.35	0.61	0.48	POINT	44.00	14.00
Type C	18	Pad 1 Gens	CAT 3516C	2,500	2	1.05	1.10	1.20	0.90	0.96	0.43	0.41	0.39	0.37	0.34	POINT	39.01	18.00

[1] Small generator emission factors provided by the manufacturer in grams/kW-hr. Emission factors and fuel use at 100% load provided and utilized to determine the emission rates used in this evaluation.

[2] The manufacturers' information includes emissions rates (expressed in lbs/hr) for a range of generator loads for all engine types used at the facility. The emission rates and fuel use values shown here are not to be exceeded per the manufacturer's specifications based on the generator rated speed with potential site variation.

[3] PM/PM10/PM2.5 emission rates for all units are obtained from the manufacturer's PM + HC data in order to represent both filterable and condensable PM in the generator emission estimates.

[4] Dispersion parameters provided by the manufacturer.

[5] Type A.1 and A.2 represent the same generators. Type A.1 utilizes generator data from uncontrolled operations while Type A.2 utilizes data from controlled operations. Aftertreatment systems for the Tier 2 compliant 2,750 kW units can either be supplied by either Miratech or Safety Power. The minimum control efficiency between the two manufacturers for each pollutant will be used. Control efficiencies are found below:

Pollutant	Miratech	Safety Power
NOx	91.7%	91.7%
DPM	68.6%	75.6%
NMHC	50%	40%
CO	70%	80%

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Generator Emission Calculation Inputs

Type	Quantity	*Gen Use* Gen Use	*Make* Make	Size *Size* (kW)	*Tier*	Temperature (K)[4] *TMP_0.85* 85%	*TMP_0.8* 80%	*TMP_0.75* 75%	*TMP_0.5* 50%	*TMP_0.3* 30%	*TMP_0.25* 25%	*TMP_0.1* 10%	Exhaust Flow Rate (acfm)[4] *EXH_0.85* 85%	*EXH_0.8* 80%	*EXH_0.75* 75%	*EXH_0.5* 50%	*EXH_0.3* 30%	*EXH_0.25* 25%	*EXH_0.1* 10%
Type A.1	26	Pad 2 Gens_Uncontrolled	CAT 3516E_Uncontrolled	2,750	4 Uncontrolled	728.43	726.59	725.59	721.09	706.09	695.32	608.93	19,374	18,607	17,824	14,066	9,894	8,813	5,743
Type A.2	26	Pad 2 Gens_Controlled	CAT3516E_Controlled	2,750	4 Controlled	728.43	726.59	725.59	721.09	706.09	695.32	608.93	19,374	18,607	17,824	14,066	9,894	8,813	5,743
Type B	1	Pad 2 House	CAT 3516C	2,000	2	645.98	640.54	635.71	618.71	616.48	611.87	562.48	13,769	13,331	12,898	10,139	6,990	6,328	4,478
Type C	18	Pad 1 Gens	CAT 3516C	2,500	2	709.04	705.76	702.48	685.98	673.59	661.93	567.93	16,369	15,741	15,126	11,701	8,121	7,238	4,428

[1] Small generator emission factors provided by the manufacturer in grams/kW-hr. Emission factors and fuel use at 100% load provided and utilized to determine the emission rates used in this evaluation.

[2] The manufacturers' information includes emissions rates (expressed in lbs/hr) for a range of generator loads for all engine types used at the facility. The emission rates and fuel use values shown here are not to be exceeded per the manufacturer's specifications based on the generator rated speed with potential site variation.

[3] PM/PM10/PM2.5 emission rates for all units are obtained from the manufacturer's PM + HC data in order to represent both filterable and condensable PM in the generator emission estimates.

[4] Dispersion parameters provided by the manufacturer.

[5] Type A.1 and A.2 represent the same generators. Type A.1 utilizes generator data from uncontrolled operations while Type A.2 utilizes data from controlled operations. Aftertreatment systems for the Tier 2 compliant 2,750 kW units can either be supplied by either Miratech or Safety Power. The minimum control efficiency between the two manufacturers for each pollutant will be used. Control efficiencies are found below:

Pollutant	Miratech	Safety Power
NOx	91.7%	91.7%
DPM	68.6%	75.6%
NMHC	50%	40%
CO	70%	80%

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Generator Maximum Emission Factor Determination

Type	Gen Use	Make	Size (kW)	NO_x Emission Factors (lb/gal)[1,2]					
				NOx_0.85	*NOx_0.75*	*NOx_0.5*	*NOx_0.25*	*NOx_0.1*	*NOx_MAX*
				85%	**75%**	**50%**	**25%**	**10%**	**MAX**
Type A.1	Pad 2 Gens_Uncontrolled	CAT 3516E_Uncontrolled	2,750	2.51E-01	2.20E-01	1.56E-01	1.47E-01	2.84E-01	2.84E-01
Type A.2	Pad 2 Gens_Controlled	CAT3516E_Controlled	2,750	2.08E-02	1.83E-02	1.30E-02	1.22E-02	2.36E-02	2.36E-02
Type B	Pad 2 House	CAT 3516C	2,000	2.54E-01	2.14E-01	1.67E-01	2.11E-01	2.48E-01	2.54E-01
Type C	Pad 1 Gens	CAT 3516C	2,500	2.63E-01	2.33E-01	1.59E-01	1.38E-01	2.27E-01	2.63E-01

[1] Emission factors in lb/gal are calculated by dividing the manufacturer's emission factors by fuel consumption. The maximum calculated emission factors are used for this inventory.

[2] Type A.1 and A.2 represent the same generators.

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Generator Maximum Emission Factor Determination

Type	Gen Use	Make	Size (kW)	CO Emission Factors (lb/gal)[1,2]					
				CO_0.85	*CO_0.75*	*CO_0.5*	*CO_0.25*	*CO_0.1*	*CO_MAX*
				85%	**75%**	**50%**	**25%**	**10%**	**MAX**
Type A.1	Pad 2 Gens_Uncontrolled	CAT 3516E_Uncontrolled	2,750	2.77E-02	2.54E-02	2.44E-02	6.63E-02	1.14E-01	1.14E-01
Type A.2	Pad 2 Gens_Controlled	CAT3516E_Controlled	2,750	8.31E-03	7.62E-03	7.31E-03	1.99E-02	3.43E-02	3.43E-02
Type B	Pad 2 House	CAT 3516C	2,000	2.05E-02	1.77E-02	2.58E-02	8.85E-02	1.51E-01	1.51E-01
Type C	Pad 1 Gens	CAT 3516C	2,500	2.34E-02	2.16E-02	2.48E-02	5.77E-02	1.50E-01	1.50E-01

[1] Emission factors in lb/gal are calculated by dividing the manufacturer's emission factors by fuel consumption. The maximum calculated emission factors are used for this inventory.
[2] Type A.1 and A.2 represent the same generators.

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Generator Maximum Emission Factor Determination

Type	Gen Use	Make	Size (kW)	PM/PM_{10}/$PM_{2.5}$ Emission Factors (lb/gal)[1,2,3]					
				PM_0.85	*PM_0.75*	*PM_0.5*	*PM_0.25*	*PM_0.1*	*PM_MAX*
				85%	**75%**	**50%**	**25%**	**10%**	**MAX**
Type A.1	Pad 2 Gens_Uncontrolled	CAT 3516E_Uncontrolled	2,750	3.37E-03	3.45E-03	4.26E-03	6.93E-03	8.10E-03	8.10E-03
Type A.2	Pad 2 Gens_Controlled	CAT3516E_Controlled	2,750	1.06E-03	1.08E-03	1.34E-03	2.17E-03	2.54E-03	2.54E-03
Type B	Pad 2 House	CAT 3516C	2,000	2.94E-03	3.13E-03	4.59E-03	1.39E-02	1.82E-02	1.82E-02
Type C	Pad 1 Gens	CAT 3516C	2,500	2.90E-03	3.11E-03	4.06E-03	6.44E-03	1.11E-02	1.11E-02

[1] Emission factors in lb/gal are calculated by dividing the manufacturer's emission factors by fuel consumption. The maximum calculated emission factors are used for this inventory.

[2] Type A.1 and A.2 represent the same generators.

[3] PM/PM_{10}/$PM_{2.5}$ emission factors for all units are obtained from the manufacturer's PM + HC data in order to represent potential filterable and condensable PM in the generator emission estimates.

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Generator Maximum Emission Factor Determination

Type	Gen Use	Make	Size (kW)	VOC Emission Factors (lb/gal)[1,2] VOC_0.85 85%	VOC_0.75 75%	VOC_0.5 50%	VOC_0.25 25%	VOC_0.1 10%	VOC_MAX MAX
Type A.1	Pad 2 Gens_Uncontrolled	CAT 3516E_Uncontrolled	2,750	5.19E-03	5.70E-03	7.26E-03	1.13E-02	1.52E-02	1.52E-02
Type A.2	Pad 2 Gens_Controlled	CAT3516E_Controlled	2,750	3.11E-03	3.42E-03	4.35E-03	6.77E-03	9.14E-03	9.14E-03
Type B	Pad 2 House	CAT 3516C	2,000	9.89E-03	1.07E-02	1.48E-02	2.04E-02	3.75E-02	3.75E-02
Type C	Pad 1 Gens	CAT 3516C	2,500	7.11E-03	8.26E-03	1.24E-02	1.57E-02	3.11E-02	3.11E-02

[1] Emission factors in lb/gal are calculated by dividing the manufacturer's emission factors by fuel consumption. The maximum calculated emission factors are used for this inventory.

[2] Type A.1 and A.2 represent the same generators.

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Emergency and Non-Emergency Emissions

Type	Quantity	EPA Tier Rating	All Hours of Operation (hrs/yr/gen)	85% Load Fuel Use (gal/hr/gen)	Maximum Emission Factor[1,2] (lbs/gal) NOx	CO	VOC	PM	Fuel Use[3] (gal/yr)	Emission Rate (tpy) NOx	CO	VOC	PM
Type A.1	26	4 Uncontrolled	19	163.90	0.28	0.11	1.52E-02	8.10E-03	78,996	11.24	--	--	--
Type A.2	26	4 Controlled	15	163.90	0.02	0.03	9.14E-03	2.54E-03	64,589	0.76	2.46	0.66	0.18
Type B	1	2	34	117.30	0.25	0.15	3.75E-02	1.82E-02	3,952	0.50	0.30	0.07	0.04
Type C	18	2	34	147.60	0.26	0.15	3.11E-02	1.11E-02	89,520	11.76	6.69	1.39	0.50
								Facility Total	**237,058**	**24.3**	**9.5**	**2.1**	**0.7**

[1] Emission factors in lb/gal are calculated by dividing the manufacturer's potential site variation mass emission rates by fuel consumption. The maximum calculated emission factors are used for this inventory.

[2] $PM/PM_{10}/PM_{2.5}$ emission factors for all units are obtained from the manufacturer's PM + HC data in order to represent potential filterable and condensable PM in the generator emission estimates.

[3] Fuel use calculated based on total expected operating hours for each engine type assuming the unit is run at 85% load.

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Generator HAP Emission Calculations

Generator HAP Emission Rate Inputs

Type	Gen Use	Make	Size (kW)	Generator Fuel Use at 100% Load gal/hr	Number	Annual Non-Emergency Fuel Use [1] gal/yr
Type A.1	Pad 2 Gens_Uncontrolled	CAT 3516E_Uncontrolled	2,750	163.90	26	78,996
Type A.2	Pad 2 Gens_Controlled	CAT3516E_Controlled	2,750	163.90	26	64,589
Type B	Pad 2 House	CAT 3516C	2,000	117.30	1	3,952
Type C	Pad 1 Gens	CAT 3516C	2,500	147.60	18	89,520

Pollutant	Spike Duration (seconds)[2]	Cold-Start Emission Spike (ppm) [3]	Steady-State (Warm) Emissions (ppm) [2]	Cold-Start Scaling Factor	Cold Start Emission Ratio on Hourly Basis
PM and Organics	14	900	30	4.27	0.054
CO and Formaldehyde	20	750	30	4.83	0.064
Cold Start Events per Generator[1]	30	cold start events/yr			

HAP Emission Factors

Pollutant	CAS	HAP?	Cold Start? [2]	Emission Factor (lbs/1000 gal)[3]			Tier 4 Control Efficiency [4] (%)	Tier 4 Control Efficiency, Miratech (%)	Tier 4 Control Efficiency, Safety Power (%)
				Type A Units	Type B Units	Type C Units			
Acenaphthene - PAH	83-32-9	Yes - PAH	Yes	6.02E-04	6.02E-04	6.02E-04	0%	0%	0%
Acenaphthylene - PAH	208-96-8	Yes - PAH	Yes	1.19E-03	1.19E-03	1.19E-03	0%	0%	0%
Acetaldehyde	75-07-0	Yes	Yes	3.24E-03	3.24E-03	3.24E-03	0%	0%	0%
Acrolein	107-02-8	Yes	Yes	1.01E-03	1.01E-03	1.01E-03	0%	0%	0%
Anthracene - PAH	120-12-7	Yes - PAH	Yes	1.58E-04	1.58E-04	1.58E-04	0%	0%	0%
Benz[a]anthracene - PAH	56-55-3	Yes - PAH	Yes	8.01E-05	8.01E-05	8.01E-05	0%	0%	0%
Benzene	71-43-2	Yes	Yes	9.99E-02	9.99E-02	9.99E-02	0%	0%	0%
Benzo[a]pyrene - PAH	50-32-8	Yes - PAH	Yes	3.31E-05	3.31E-05	3.31E-05	0%	0%	0%
Benzo[b]fluoranthene - PAH	205-99-2	Yes - PAH	Yes	1.43E-04	1.43E-04	1.43E-04	0%	0%	0%
Benzo[g,h,i]perylene - PAH	191-24-2	Yes - PAH	Yes	7.16E-05	7.16E-05	7.16E-05	0%	0%	0%
Benzo[k]fluoranthene - PAH	207-08-9	Yes - PAH	Yes	2.81E-05	2.81E-05	2.81E-05	0%	0%	0%
Chrysene - PAH	218-01-9	Yes - PAH	Yes	1.97E-04	1.97E-04	1.97E-04	0%	0%	0%
Dibenz[a,h]anthracene - PAH	53-70-3	Yes - PAH	Yes	4.45E-05	4.45E-05	4.45E-05	0%	0%	0%
Ethyl Benzene	100-41-4	Yes	Yes	0	0.00E+00	0.00E+00	0%	0%	0%
Fluoranthene - PAH	206-44-0	Yes - PAH	Yes	5.19E-04	5.19E-04	5.19E-04	0%	0%	0%
Fluorene - PAH	86-73-7	Yes - PAH	Yes	1.65E-03	1.65E-03	1.65E-03	0%	0%	0%
Formaldehyde	50-00-0	Yes	Yes	1.02E-02	1.02E-02	1.02E-02	70%	70%	80%
Indeno[1,2,3-cd]pyrene - PAH	193-39-5	Yes - PAH	Yes	5.33E-05	5.33E-05	5.33E-05	0%	0%	0%
Naphthalene - PAH	91-20-3	Yes - PAH	Yes	1.67E-02	1.67E-02	1.67E-02	0%	0%	0%
Phenanthrene - PAH	85-01-8	Yes - PAH	Yes	5.25E-03	5.25E-03	5.25E-03	0%	0%	0%
Pyrene - PAH	129-00-0	Yes - PAH	Yes	4.78E-04	4.78E-04	4.78E-04	0%	0%	0%
PAHs (excl. Naphthalene) - PAH	401	Yes - PAH	Yes	1.06E-02	1.06E-02	1.06E-02	0%	0%	0%
Toluene	108-88-3	Yes	Yes	3.62E-02	3.62E-02	3.62E-02	0%	0%	0%
Xylenes	1330-20-7	Yes	Yes	2.48E-02	2.48E-02	2.48E-02	0%	0%	0%

Annual HAP Emissions for Non-Emergency Usage

Pollutant	Maximum Projected Emissions (lbs/yr) [5]							
	Type A.1 2750	Type A.2 2750	Type B 2000	Type C 2500	-- #N/A	-- #N/A	-- #N/A	Total
Acenaphthene - PAH	4.76E-02	3.89E-02	2.38E-03	5.39E-02	--	--	--	**1.43E-01**
Acenaphthylene - PAH	9.39E-02	7.67E-02	4.70E-03	1.06E-01	--	--	--	**2.82E-01**
Acetaldehyde	2.56E-01	2.10E-01	1.28E-02	2.90E-01	--	--	--	**7.69E-01**
Acrolein	8.01E-02	6.55E-02	4.01E-03	9.08E-02	--	--	--	**2.40E-01**
Anthracene - PAH	1.25E-02	1.02E-02	6.26E-04	1.42E-02	--	--	--	**3.75E-02**
Benz[a]anthracene - PAH	6.33E-03	5.17E-03	3.16E-04	7.17E-03	--	--	--	**1.90E-02**
Benzene	7.89E+00	6.45E+00	3.95E-01	8.94E+00	--	--	--	**2.37E+01**
Benzo[a]pyrene - PAH	2.61E-03	2.14E-03	1.31E-04	2.96E-03	--	--	--	**7.84E-03**
Benzo[b]fluoranthene - PAH	1.13E-02	9.23E-03	5.65E-04	1.28E-02	--	--	--	**3.39E-02**
Benzo[g,h,i]perylene - PAH	5.65E-03	4.62E-03	2.83E-04	6.41E-03	--	--	--	**1.70E-02**
Benzo[k]fluoranthene - PAH	2.22E-03	1.81E-03	1.11E-04	2.51E-03	--	--	--	**6.65E-03**
Chrysene - PAH	1.56E-02	1.27E-02	7.78E-04	1.76E-02	--	--	--	**4.67E-02**
Dibenz[a,h]anthracene - PAH	3.52E-03	2.88E-03	1.76E-04	3.99E-03	--	--	--	**1.06E-02**
Ethyl Benzene	0	0	0	0	--	--	--	**0**
Fluoranthene - PAH	4.10E-02	3.35E-02	2.05E-03	4.64E-02	--	--	--	**1.23E-01**
Fluorene - PAH	1.30E-01	1.06E-01	6.51E-03	1.48E-01	--	--	--	**3.91E-01**
Formaldehyde	2.41E-01	1.97E-01	4.01E-02	9.09E-01	--	--	--	**1.39E+00**
Indeno[1,2,3-cd]pyrene - PAH	4.21E-03	3.44E-03	2.11E-04	4.77E-03	--	--	--	**1.26E-02**
Naphthalene - PAH	1.32E+00	1.08E+00	6.61E-02	1.50E+00	--	--	--	**3.97E+00**
Phenanthrene - PAH	4.15E-01	3.39E-01	2.08E-02	4.70E-01	--	--	--	**1.25E+00**
Pyrene - PAH	3.77E-02	3.08E-02	1.89E-03	4.28E-02	--	--	--	**1.13E-01**
PAHs (excl. Naphthalene) - PAH	8.34E-01	6.82E-01	4.17E-02	9.45E-01	--	--	--	**2.50E+00**
Toluene	2.86E+00	2.34E+00	1.43E-01	3.24E+00	--	--	--	**8.58E+00**
Xylenes	1.96E+00	1.60E+00	9.82E-02	2.22E+00	--	--	--	**5.89E+00**
Total HAP (tpy)	**8.14E-03**	**6.65E-03**	**4.21E-04**	**9.54E-03**	**0**	**0**	**0**	**0.02**

[1] The number of cold start events per generator, per year is based on expected testing and maintenance operations.

[2] Spike duration, cold-start emission spike, and steady-state (warm) emissions based on data from California Energy Commission (CEC) "Air Quality Implications of Backup Generators in California. The cold-start scaling factor is derived as the ratio of the spike concentration and duration to the steady-state emissions for the initial 60 seconds. Since a cold-start curve was not developed by CEC, it is assumed that the PM will experience the same trend as HC, and formaldehyde will experience the same trend as CO. A cold start event assumes 1 minute of cold start operation with spike in emissions and the remaining 59 minutes in the hour operating steady state. The cold start emission ratio shown below on hourly basis will be applied as: the hourly emission rate with cold start event = normal hourly emission rate x (1+ratio shown below on hourly basis). Consistent with DEQ's guidance on risk assessment for emergency engines, the cold start emissions are accounted for toxics that are organics and DPM. Metal toxics do not have higher emissions during cold start events.

[3] Emission factors from AP-42 Section 3.4, Table 3.4-3 "Speciated Organic Compound Emission Factors for Large Uncontrolled Stationary Diesel Engines" and Table 3.4.-4 "PAH Emission Factors for Large Uncontrolled Stationary Diesel Engines," Supplement B, October 1996.

[4] Tier 4 control efficiency per pollutant is the minimum value between the controls provided by Miratech and Safety Power. Besides Formaldehyde, HAP controls were not provided by Miratech and Safety Power. All other controls are set at 0.

[5] Maximum project emissions are determined multiplying the emission factor by the projected fuel throughput for each generator type.

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Generator HAP Emission Summary

Total HAPs

Hazardous Air Pollutants	Potential to Emit (pounds/year)[1] Combined Non-emergency and Emergency
1,3-Butadiene	0.00
Acetaldehyde	1
Acrolein	0.24
Antimony	0.00
Arsenic	0.00
Benzene	23.68
Beryllium	0.00E+00
Cadmium	0.00E+00
Chlorobenzene	0.00E+00
Cobalt	0.00E+00
Ethyl Benzene	0.00
Formaldehyde	1
Hexane	0.00
Hexavalent Chromium	0.00
Hydrogen Chloride	0
Lead	0.00
Manganese	0.00
Mercury	0.00
Naphthalene - PAH	3.97
Nickel	0.00
PAH Total (Excl. Naphthalene)	4.99
Selenium	0.00
Toluene	8.58
Xylenes	5.89
Total HAP Emissions	**49.50**

Polycyclic Aromatic Hydrocarbons (PAHs)	Potential to Emit (pounds/year) Combined Non-emergency and Emergency
Acenaphthene - PAH	0.14
Acenaphthylene - PAH	0.28
Anthracene - PAH	0.04
Benz[a]anthracene - PAH	0.02
Benzo[a]pyrene - PAH	7.84E-03
Benzo[b]fluoranthene - PAH	0.03
Benzo[e]pyrene - PAH	0.00
Benzo[g,h,i]perylene - PAH	1.70E-02
Benzo[k]fluoranthene - PAH	6.65E-03
Chrysene - PAH	0.05
Dibenz[a,h]anthracene - PAH	1.06E-02
Fluoranthene - PAH	0.12
Fluorene - PAH	0.39
Indeno[1,2,3-cd]pyrene - PAH	1.26E-02
2-Methyl naphthalene - PAH	0.00
Perylene - PAH	0.00E+00
Phenanthrene - PAH	1.25
Pyrene - PAH	0.11
PAHs (excl. Naphthalene) - PAH	2.50E+00
Total PAHs Emissions (excl. Naphthalene)	**4.99**

[1] PTE calculated for permitted fuel limits

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Sulfur Dioxide Emission Factor Determination and Calculations - All Generators

SO_2 Emission Factor Calculation

ULSD Sulfur Content [1]	0.0015	percent
Fuel Density [1]	7.09	lb/gallon
Atomic Weight Sulfur	32.06	amu
Atomic Weight Oxygen	16.00	amu

Calculated SO_2 Emission Factor [2]	**2.12E-04**	**lbs / gal**

SO_2 Emission Rate Calculation

Type	Generator Use	Generator Model	SO_2 Emission Factor (lbs/gal)	Annual Usage - Total (gallons/yr)	Annual Emissions - Total (tpy)
Type A.1	Pad 2 Gens_Uncontrolled	CAT 3516E_Uncontrolled	2.12E-04	78,996	8.39E-03
Type A.2	Pad 2 Gens_Controlled	CAT3516E_Controlled	2.12E-04	64,589	6.86E-03
Type B	Pad 2 House	CAT 3516C	2.12E-04	3,952	4.20E-04
Type C	Pad 1 Gens	CAT 3516C	2.12E-04	89,520	9.51E-03
				Total	**2.52E-02**

[1] NSPS Subpart IIII sulfur limit for nonroad ULSD diesel fuel [40 CFR 80.510(b)]. Vendor provided fuel density.

[2] SO_2: Mass balance assuming 100% conversion of combusted Sulfur to SO_2: SO_2 Emissions (lb/gal) = (Fuel Gas Sulfur Content (%) * Fuel Density (lb/gal) * (64 lb/lbmol SO_2 / 32 lb/lbmol S)

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Amazon Data Services - DEN-22 Data Center

Greenhouse Gas Emission Factor Determination and Calculations - All Generators

40 CFR 98, Table A-1 and C-1, C-2

Default High Heat Value	0.138	MMBtu/gal

Pollutant	Distillate Fuel Oil No. 2 Emission Factors		GWP
CO_2	73.96	kg/MMBtu	1
N_2O	0.0006	kg/MMBtu	265
CH_4	0.003	kg/MMBtu	28

Calculated GHG Parameters[1]

Pollutant	Emission Factor	CO_2e Emission Factor	
CO_2	22,501	22,501	lbs/1,000 gal
N_2O	0.18	48.37	lbs/1,000 gal
CH_4	0.91	25.56	lbs/1,000 gal
Total CO_2e (all generators)		**22,575**	**lbs/1,000 gal**

GHG Emission Rate Calculation

Type	Generator Use	Generator Model	CO_2e Emission Factor (lbs/gal)	Annual Usage - Total (gallons/yr)	Annual Emissions - Total (tpy)
Type A.1	Pad 2 Gens_Uncontrolled	CAT 3516E_Uncontrolled	22.58	78,996	891.7
Type A.2	Pad 2 Gens_Controlled	CAT3516E_Controlled	22.58	64,589	729.1
Type B	Pad 2 House	CAT 3516C	22.58	3,952	44.6
Type C	Pad 1 Gens	CAT 3516C	22.58	89,520	1,010.5
				Total	**2,676**

[1] Emission rates in pounds per thousand gallon (lbs/1,000 gal) for Carbon Dioxide (CO_2), Nitrous oxide (N_2O), and Methane (CH_4) are calculated using the default high heat value of diesel and pollutant emission factors from 40 CFR 98, Table A-1 and C-1, and C-2. Total carbon dioxide equivalent (CO2e) is determined by multiplying the calculated emission factor by the pollutant-specific global warming potential.

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PERFORMANCE DATA[EM1895]

January 30, 2023

Ready for Spider

Performance Number: EM1895

Change Level: 07

SALES MODEL:	3516C	**COMBUSTION:**	DIRECT INJECTION
BRAND:	CAT	**ENGINE SPEED (RPM):**	1,800
MACHINE SALES MODEL:		**HERTZ:**	60
ENGINE POWER (BHP):	3,634	**FAN POWER (HP):**	130.1
GEN POWER WITH FAN (EKW):	2,500.0	**ASPIRATION:**	TA
COMPRESSION RATIO:	14.7	**AFTERCOOLER TYPE:**	ATAAC
RATING LEVEL:	MISSION CRITICAL STANDBY	**AFTERCOOLER CIRCUIT TYPE:**	JW+OC, ATAAC
PUMP QUANTITY:	1	**INLET MANIFOLD AIR TEMP (F):**	122
FUEL TYPE:	DIESEL	**JACKET WATER TEMP (F):**	219.2
MANIFOLD TYPE:	DRY	**TURBO CONFIGURATION:**	PARALLEL
GOVERNOR TYPE:	ADEM3	**TURBO QUANTITY:**	4
ELECTRONICS TYPE:	ADEM3	**TURBOCHARGER MODEL:**	GT6041BN-48T-1.10
CAMSHAFT TYPE:	STANDARD	**CERTIFICATION YEAR:**	2006
IGNITION TYPE:	CI	**CRANKCASE BLOWBY RATE (FT3/HR):**	3,619.4
INJECTOR TYPE:	EUI	**FUEL RATE (RATED RPM) NO LOAD (GAL/HR):**	16.0
FUEL INJECTOR:	3920221	**PISTON SPD @ RATED ENG SPD (FT/MIN):**	2,539.4
UNIT INJECTOR TIMING (IN):	64.34		
REF EXH STACK DIAMETER (IN):	12		
MAX OPERATING ALTITUDE (FT):	2,953		

INDUSTRY	SUBINDUSTRY	APPLICATION
ELECTRIC POWER	STANDARD	PACKAGED GENSET
OIL AND GAS	LAND PRODUCTION	PACKAGED GENSET

General Performance Data

THIS STANDBY RATING IS FOR A STANDBY ONLY ENGINE ARRANGEMENT. RERATING THE ENGINE TO A PRIME OR CONTINUOUS RATING IS NOT PERMITTED.

THE INLET MANIFOLD AIR TEMP LISTED IN THE HEADER, AND IN THE GENERAL PERFORMANCE DATA, IS THE AVERAGE INLET MANIFOLD TEMP FRONT TO REAR ON THE ENGINE.

GENSET POWER WITH FAN	PERCENT LOAD	ENGINE POWER	BRAKE MEAN EFF PRES (BMEP)	BRAKE SPEC FUEL CONSUMPTN (BSFC)	ISO BRAKE SPEC FUEL CONSUMPTN (BSFC)	VOL FUEL CONSUMPTN (VFC)	ISO VOL FUEL CONSUMPTN (VFC)	ELEC SPEC FUEL CONSUMPTN (ESFC)	ISO ELEC SPEC FUEL CONSUMPTN (ESFC)
EKW	%	BHP	PSI	LB/BHP-HR	LB/BHP-HR	GAL/HR	GAL/HR	LB/EKW-HR	LB/EKW-HR
2,500.0	100	3,633	336	0.334	0.328	171.3	168.0	0.486	0.477
2,250.0	90	3,283	303	0.335	0.329	155.1	152.1	0.489	0.480
2,125.0	85	3,109	287	0.337	0.330	147.6	144.8	0.493	0.483
2,000.0	80	2,935	271	0.339	0.333	140.4	137.7	0.498	0.489
1,875.0	75	2,760	255	0.342	0.336	133.2	130.7	0.504	0.494
1,750.0	70	2,586	239	0.346	0.339	126.0	123.6	0.511	0.501
1,500.0	60	2,237	207	0.354	0.347	111.5	109.4	0.527	0.517
1,250.0	50	1,889	174	0.365	0.358	97.1	95.2	0.551	0.540
1,000.0	40	1,547	143	0.373	0.366	81.4	79.8	0.577	0.566
750.0	30	1,203	111	0.385	0.378	65.3	64.1	0.618	0.606
625.0	25	1,029	95	0.394	0.386	57.2	56.1	0.649	0.637
500.0	20	854	79	0.403	0.396	48.6	47.6	0.689	0.676
250.0	10	497	46	0.441	0.433	30.9	30.3	0.877	0.860

GENSET POWER WITH FAN	PERCENT LOAD	ENGINE POWER	INLET MFLD PRES	INLET MFLD TEMP	EXH MFLD TEMP	EXH MFLD PRES	ENGINE OUTLET TEMP	COMPRESSOR OUTLET PRES	COMPRESSOR OUTLET TEMP
EKW	%	BHP	IN-HG	DEG F	DEG F	IN-HG	DEG F	IN-HG	DEG F
2,500.0	100	3,633	78.1	121.9	1,235.7	67.6	853.1	85	466.7
2,250.0	90	3,283	71.3	119.4	1,190.0	61.3	824.5	78	443.1
2,125.0	85	3,109	67.8	118.1	1,173.2	58.3	816.6	74	430.6
2,000.0	80	2,935	64.3	116.9	1,158.9	55.3	810.7	70	417.8
1,875.0	75	2,760	60.7	115.8	1,145.6	52.3	804.8	66	404.7
1,750.0	70	2,586	57.1	114.7	1,133.3	49.3	798.9	63	391.3
1,500.0	60	2,237	49.5	112.7	1,112.4	43.2	787.1	55	363.6
1,250.0	50	1,889	41.3	111.0	1,091.8	36.8	775.1	46	334.7
1,000.0	40	1,547	31.4	109.4	1,061.5	29.3	770.6	36	297.5
750.0	30	1,203	21.7	107.9	1,010.3	22.1	752.8	25	249.8
625.0	25	1,029	17.2	107.2	968.3	18.7	731.8	21	223.4
500.0	20	854	12.7	106.4	902.0	15.5	695.6	16	197.2
250.0	10	497	4.8	104.1	700.7	9.8	562.6	7	152.3

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PERFORMANCE DATA[EM1895]

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General Performance Data (Continued)

GENSET POWER WITH FAN	PERCENT LOAD	ENGINE POWER	WET INLET AIR VOL FLOW RATE	ENGINE OUTLET WET EXH GAS VOL FLOW RATE	WET INLET AIR MASS FLOW RATE	WET EXH GAS MASS FLOW RATE	WET EXH VOL FLOW RATE (32 DEG F AND 29.98 IN HG)	DRY EXH VOL FLOW RATE (32 DEG F AND 29.98 IN HG)
EKW	%	BHP	CFM	CFM	LB/HR	LB/HR	FT3/MIN	FT3/MIN
2,500.0	100	3,633	7,133.1	18,497.4	31,696.1	32,910.2	6,927.7	6,289.9
2,250.0	90	3,283	6,756.8	17,036.6	29,886.4	30,985.9	6,522.8	5,944.9
2,125.0	85	3,109	6,558.4	16,368.9	28,967.7	30,012.0	6,306.1	5,756.2
2,000.0	80	2,935	6,350.9	15,740.8	28,028.8	29,019.5	6,092.1	5,568.4
1,875.0	75	2,760	6,132.5	15,125.9	27,059.2	27,998.2	5,881.4	5,382.5
1,750.0	70	2,586	5,902.5	14,507.6	26,056.9	26,945.9	5,667.5	5,192.6
1,500.0	60	2,237	5,408.9	13,196.0	23,934.4	24,726.5	5,204.1	4,777.6
1,250.0	50	1,889	4,844.0	11,701.1	21,447.3	22,136.3	4,659.1	4,284.7
1,000.0	40	1,547	4,122.0	9,918.3	18,264.4	18,842.5	3,963.7	3,647.8
750.0	30	1,203	3,423.6	8,121.4	15,177.8	15,642.9	3,293.2	3,036.5
625.0	25	1,029	3,105.0	7,237.8	13,766.9	14,173.7	2,986.8	2,759.5
500.0	20	854	2,791.1	6,276.7	12,375.6	12,721.7	2,671.3	2,475.8
250.0	10	497	2,236.2	4,428.4	9,910.4	10,129.4	2,129.9	1,997.8

Heat Rejection Data

GENSET POWER WITH FAN	PERCENT LOAD	ENGINE POWER	REJECTION TO JACKET WATER	REJECTION TO ATMOSPHERE	REJECTION TO EXH	EXHAUST RECOVERY TO 350F	FROM OIL COOLER	FROM AFTERCOOLER	WORK ENERGY	LOW HEAT VALUE ENERGY	HIGH HEAT VALUE ENERGY
EKW	%	BHP	BTU/MIN	BTU/MIN	BTU/MIN	BTU/MIN	BTU/MIN	BTU/MIN	BTU/MIN	BTU/MIN	BTU/MIN
2,500.0	100	3,633	46,992	9,146	142,265	70,115	19,835	44,723	154,077	372,403	396,702
2,250.0	90	3,283	44,242	8,557	127,929	62,041	17,960	39,380	139,243	337,204	359,207
2,125.0	85	3,109	42,864	8,341	122,176	59,013	17,099	36,757	131,841	321,028	341,975
2,000.0	80	2,935	41,477	8,162	116,879	56,282	16,262	34,167	124,444	305,311	325,233
1,875.0	75	2,760	40,076	8,007	111,588	53,551	15,425	31,612	117,053	289,608	308,505
1,750.0	70	2,586	38,657	7,874	106,293	50,817	14,588	29,085	109,651	273,881	291,752
1,500.0	60	2,237	35,755	7,684	95,729	45,311	12,915	24,201	94,874	242,485	258,307
1,250.0	50	1,889	32,626	7,527	85,184	39,388	11,245	19,401	80,109	211,118	224,893
1,000.0	40	1,547	29,235	7,262	72,693	33,148	9,427	13,873	65,583	176,995	188,544
750.0	30	1,203	25,476	6,784	59,425	26,293	7,565	8,706	51,005	142,037	151,305
625.0	25	1,029	23,394	6,435	52,542	22,520	6,621	6,496	43,653	124,317	132,429
500.0	20	854	21,006	5,995	44,739	18,221	5,624	4,534	36,223	105,594	112,484
250.0	10	497	15,737	5,026	27,795	8,787	3,578	1,916	21,071	67,181	71,564

Sound Data

SOUND PRESSURE DATA FOR THIS RATING CAN BE FOUND IN PERFORMANCE NUMBER - DM8779.

Emissions Data

DIESEL

RATED SPEED NOMINAL DATA: 1800 RPM

GENSET POWER WITH FAN	EKW	2,500.0	2,125.0	1,875.0	1,250.0	625.0	250.0
PERCENT LOAD	%	100	85	75	50	25	10
ENGINE POWER	BHP	3,633	3,109	2,760	1,889	1,029	497
TOTAL NOX (AS NO2)	G/HR	19,123	14,654	11,751	5,837	2,974	2,654
TOTAL CO	G/HR	1,515	869	725	607	831	1,165

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TOTAL HC		G/HR	376	359	375	408	307	329
TOTAL CO2		KG/HR	1,740	1,491	1,340	966	559	296
PART MATTER		G/HR	132.5	87.7	88.4	94.3	99.6	100.7
TOTAL NOX (AS NO2)	(CORR 5% O2)	MG/NM3	2,349.1	2,110.7	1,857.9	1,286.9	1,127.3	1,858.5
TOTAL CO	(CORR 5% O2)	MG/NM3	195.4	129.4	118.8	140.1	330.3	862.6
TOTAL HC	(CORR 5% O2)	MG/NM3	42.1	47.1	54.8	81.8	105.8	212.3
PART MATTER	(CORR 5% O2)	MG/NM3	14.1	10.7	11.8	18.4	34.7	63.0
TOTAL NOX (AS NO2)	(CORR 15% O2)	MG/NM3	871.7	783.2	689.4	477.5	418.3	689.6
TOTAL CO	(CORR 15% O2)	MG/NM3	72.5	48.0	44.1	52.0	122.6	320.1
TOTAL HC	(CORR 15% O2)	MG/NM3	15.6	17.5	20.3	30.4	39.3	78.8
PART MATTER	(CORR 15% O2)	MG/NM3	5.2	4.0	4.4	6.8	12.9	23.4
TOTAL NOX (AS NO2)	(CORR 5% O2)	PPM	1,144	1,028	905	627	549	905
TOTAL CO	(CORR 5% O2)	PPM	156	104	95	112	264	690
TOTAL HC	(CORR 5% O2)	PPM	79	88	102	153	197	396
TOTAL NOX (AS NO2)	(CORR 15% O2)	PPM	425	382	336	233	204	336
TOTAL CO	(CORR 15% O2)	PPM	58	38	35	42	98	256
TOTAL HC	(CORR 15% O2)	PPM	29	33	38	57	73	147
TOTAL NOX (AS NO2)		G/HP-HR	5.32	4.76	4.30	3.12	2.92	5.39
TOTAL CO		G/HP-HR	0.42	0.28	0.26	0.32	0.82	2.37
TOTAL HC		G/HP-HR	0.10	0.12	0.14	0.22	0.30	0.67
PART MATTER		G/HP-HR	0.04	0.03	0.03	0.05	0.10	0.20
TOTAL NOX (AS NO2)		G/KW-HR	7.23	6.47	5.84	4.24	3.96	7.33
TOTAL CO		G/KW-HR	0.57	0.38	0.36	0.44	1.11	3.22
TOTAL HC		G/KW-HR	0.14	0.16	0.19	0.30	0.41	0.91
PART MATTER		G/KW-HR	0.05	0.04	0.04	0.07	0.13	0.28
TOTAL NOX (AS NO2)		LB/HR	42.16	32.31	25.91	12.87	6.56	5.85
TOTAL CO		LB/HR	3.34	1.92	1.60	1.34	1.83	2.57
TOTAL HC		LB/HR	0.83	0.79	0.83	0.90	0.68	0.72
TOTAL CO2		LB/HR	3,836	3,288	2,955	2,130	1,233	654
PART MATTER		LB/HR	0.29	0.19	0.19	0.21	0.22	0.22
OXYGEN IN EXH		%	9.4	10.1	10.4	11.3	12.2	14.4
DRY SMOKE OPACITY		%	1.7	1.1	1.4	1.9	2.6	4.0
BOSCH SMOKE NUMBER			0.83	0.77	0.80	0.85	0.97	1.13

RATED SPEED POTENTIAL SITE VARIATION: 1800 RPM

GENSET POWER WITH FAN		**EKW**	**2,500.0**	**2,125.0**	**1,875.0**	**1,250.0**	**625.0**	**250.0**
PERCENT LOAD		**%**	**100**	**85**	**75**	**50**	**25**	**10**
ENGINE POWER		**BHP**	**3,633**	**3,109**	**2,760**	**1,889**	**1,029**	**497**
TOTAL NOX (AS NO2)		G/HR	22,948	17,584	14,101	7,004	3,568	3,185
TOTAL CO		G/HR	2,726	1,565	1,304	1,092	1,496	2,098
TOTAL HC		G/HR	500	478	499	543	408	437
PART MATTER		G/HR	185.5	122.8	123.7	132.1	139.5	141.0
TOTAL NOX (AS NO2)	(CORR 5% O2)	MG/NM3	2,818.9	2,532.8	2,229.5	1,544.3	1,352.7	2,230.2
TOTAL CO	(CORR 5% O2)	MG/NM3	351.8	232.9	213.9	252.3	594.6	1,552.7
TOTAL HC	(CORR 5% O2)	MG/NM3	55.9	62.7	72.8	108.8	140.7	282.4
PART MATTER	(CORR 5% O2)	MG/NM3	19.7	15.0	16.5	25.8	48.5	88.2
TOTAL NOX (AS NO2)	(CORR 15% O2)	MG/NM3	1,046.0	939.9	827.3	573.0	502.0	827.6
TOTAL CO	(CORR 15% O2)	MG/NM3	130.5	86.4	79.4	93.6	220.6	576.2
TOTAL HC	(CORR 15% O2)	MG/NM3	20.8	23.2	27.0	40.4	52.2	104.8
PART MATTER	(CORR 15% O2)	MG/NM3	7.3	5.6	6.1	9.6	18.0	32.7
TOTAL NOX (AS NO2)	(CORR 5% O2)	PPM	1,373	1,234	1,086	752	659	1,086
TOTAL CO	(CORR 5% O2)	PPM	281	186	171	202	476	1,242
TOTAL HC	(CORR 5% O2)	PPM	104	117	136	203	263	527
TOTAL NOX (AS NO2)	(CORR 15% O2)	PPM	510	458	403	279	244	403
TOTAL CO	(CORR 15% O2)	PPM	104	69	63	75	177	461
TOTAL HC	(CORR 15% O2)	PPM	39	43	50	75	97	196
TOTAL NOX (AS NO2)		G/HP-HR	6.38	5.71	5.15	3.74	3.50	6.47
TOTAL CO		G/HP-HR	0.76	0.51	0.48	0.58	1.47	4.26
TOTAL HC		G/HP-HR	0.14	0.15	0.18	0.29	0.40	0.89
PART MATTER		G/HP-HR	0.05	0.04	0.05	0.07	0.14	0.29

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TOTAL NOX (AS NO2)	G/KW-HR	8.67	7.76	7.01	5.09	4.76	8.79
TOTAL CO	G/KW-HR	1.03	0.69	0.65	0.79	2.00	5.79
TOTAL HC	G/KW-HR	0.19	0.21	0.25	0.39	0.54	1.21
PART MATTER	G/KW-HR	0.07	0.05	0.06	0.10	0.19	0.39
TOTAL NOX (AS NO2)	LB/HR	50.59	38.77	31.09	15.44	7.87	7.02
TOTAL CO	LB/HR	6.01	3.45	2.88	2.41	3.30	4.62
TOTAL HC	LB/HR	1.10	1.05	1.10	1.20	0.90	0.96
PART MATTER	LB/HR	0.41	0.27	0.27	0.29	0.31	0.31

Regulatory Information

EPA EMERGENCY STATIONARY		2011 - ----		
GASEOUS EMISSIONS DATA MEASUREMENTS PROVIDED TO THE EPA ARE CONSISTENT WITH THOSE DESCRIBED IN EPA 40 CFR PART 60 SUBPART IIII AND ISO 8178 FOR MEASURING HC, CO, PM, AND NOX. THE "MAX LIMITS" SHOWN BELOW ARE WEIGHTED CYCLE AVERAGES AND ARE IN COMPLIANCE WITH THE EMERGENCY STATIONARY REGULATIONS.				
Locality	**Agency**	**Regulation**	**Tier/Stage**	**Max Limits - G/BKW - HR**
U.S. (INCL CALIF)	EPA	STATIONARY	EMERGENCY STATIONARY	CO: 3.5 NOx + HC: 6.4 PM: 0.20

Altitude Derate Data

STANDARD

ALTITUDE CORRECTED POWER CAPABILITY (BHP)

AMBIENT OPERATING TEMP (F)	30	40	50	60	70	80	90	100	110	120	NORMAL
ALTITUDE (FT)											
0	3,634	3,634	3,634	3,634	3,634	3,634	3,634	3,634	3,634	3,634	3,634
1,000	3,634	3,634	3,634	3,634	3,634	3,634	3,634	3,634	3,634	3,561	3,634
2,000	3,634	3,634	3,634	3,634	3,634	3,634	3,634	3,604	3,541	3,480	3,634
3,000	3,628	3,628	3,628	3,628	3,628	3,603	3,537	3,474	3,413	3,354	3,628
4,000	3,504	3,504	3,504	3,504	3,504	3,471	3,408	3,347	3,289	3,232	3,504
5,000	3,384	3,384	3,384	3,384	3,384	3,344	3,283	3,225	3,168	3,113	3,384
6,000	3,269	3,269	3,269	3,269	3,269	3,221	3,162	3,105	3,051	2,998	3,269
7,000	3,159	3,159	3,159	3,159	3,159	3,101	3,044	2,990	2,937	2,887	3,159
8,000	3,052	3,052	3,052	3,052	3,041	2,985	2,930	2,878	2,827	2,779	3,052
9,000	2,950	2,950	2,950	2,950	2,926	2,872	2,820	2,769	2,721	2,674	2,950
10,000	2,851	2,851	2,851	2,851	2,815	2,763	2,713	2,664	2,617	2,544	2,851

Cross Reference

Test Spec	Setting	Engine Arrangement	Engineering Model	Engineering Model Version	Start Effective Serial Number	End Effective Serial Number
4577176	LL1858	5084280	GS336	-	SBK02000	
4581567	LL6760	5157721	PG243	-	LYM00001	

Supplementary Data

Type	Classification	Performance Number
SOUND	SOUND PRESSURE	DM8779

Performance Parameter Reference

Parameters Reference:DM9600-14

Docusign Envelope ID: 9C8EC8DC-4C18-4394-A74F-E7CCFDDA6B5F

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PERFORMANCE DATA[EM1895]

January 30, 2023

PERFORMANCE DEFINITIONS

PERFORMANCE DEFINITIONS DM9600
APPLICATION:
Engine performance tolerance values below are representative of a typical production engine tested in a calibrated dynamometer test cell at SAE J1995 standard reference conditions. Caterpillar maintains ISO9001:2000 certified quality management systems for engine test Facilities to assure accurate calibration of test equipment. Engine test data is corrected in accordance with SAE J1995. Additional reference material SAE J1228, J1349, ISO 8665, 3046-1:2002E, 3046-3:1989, 1585, 2534, 2288, and 9249 may apply in part or are similar to SAE J1995. Special engine rating request (SERR) test data shall be noted.
PERFORMANCE PARAMETER TOLERANCE FACTORS:
Power +/- 3%
Torque +/- 3%
Exhaust stack temperature +/- 8%
Inlet airflow +/- 5%
Intake manifold pressure-gage +/- 10%
Exhaust flow +/- 6%
Specific fuel consumption +/- 3%
Fuel rate +/- 5%
Specific DEF consumption +/- 3%
DEF rate +/- 5%
Heat rejection +/- 5%
Heat rejection exhaust only +/- 10%
Heat rejection CEM only +/- 10%
Heat Rejection values based on using treated water.
Torque is included for truck and industrial applications, do not use for Gen Set or steady state applications.
On C7 - C18 engines, at speeds of 1100 RPM and under these values are provided for reference only, and may not meet the tolerance listed.
On 3500 and C175 engines, at speeds below Peak Torque these values are provided for reference only, and may not meet the tolerance listed.
These values do not apply to C280/3600. For these models, see the tolerances listed below.
C280/3600 HEAT REJECTION TOLERANCE FACTORS:
Heat rejection +/- 10%
Heat rejection to Atmosphere +/- 50%
Heat rejection to Lube Oil +/- 20%
Heat rejection to Aftercooler +/- 5%
TEST CELL TRANSDUCER TOLERANCE FACTORS:
Torque +/- 0.5%
Speed +/- 0.2%
Fuel flow +/- 1.0%
Temperature +/- 2.0 C degrees
Intake manifold pressure +/- 0.1 kPa
OBSERVED ENGINE PERFORMANCE IS CORRECTED TO SAE J1995 REFERENCE AIR AND FUEL CONDITIONS.
REFERENCE ATMOSPHERIC INLET AIR
FOR 3500 ENGINES AND SMALLER
SAE J1228 AUG2002 for marine engines, and J1995 JAN2014 for other engines, reference atmospheric pressure is 100 KPA (29.61 in hg), and standard temperature is 25deg C (77 deg F) at 30% relative humidity at the stated aftercooler water temp, or inlet manifold temp.
FOR 3600 ENGINES
Engine rating obtained and presented in accordance with ISO 3046/1 and SAE J1995 JANJAN2014 reference atmospheric pressure is 100 KPA (29.61 in hg), and standard temperature is 25deg C (77 deg F) at 30% relative humidity and 150M altitude at the stated aftercooler water temperature.
MEASUREMENT LOCATION FOR INLET AIR TEMPERATURE
Location for air temperature measurement air cleaner inlet at stabilized operating conditions.
REFERENCE EXHAUST STACK DIAMETER
The Reference Exhaust Stack Diameter published with this dataset is only used for the calculation of Smoke Opacity values displayed in this dataset. This value does not necessarily represent the actual stack diameter of the engine due to the variety of exhaust stack adapter options available. Consult the price list, engine order or general dimension drawings for the actual stack diameter size ordered or options available.
REFERENCE FUEL
DIESEL
Reference fuel is #2 distillate diesel with a 35API gravity;
A lower heating value is 42,780 KJ/KG (18,390 BTU/LB) when used at 15 deg C (59 deg F), where the density is 850 G/Liter (7.0936 Lbs/Gal).
GAS
Reference natural gas fuel has a lower heating value of 33.74 KJ/L (905 BTU/CU Ft). Low BTU ratings are based on 18.64 KJ/L (500

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PERFORMANCE DATA[EM1895]

BTU/CU FT) lower heating value gas. Propane ratings are based on 87.56 KJ/L (2350 BTU/CU Ft) lower heating value gas.
ENGINE POWER (NET) IS THE CORRECTED FLYWHEEL POWER (GROSS) LESS EXTERNAL AUXILIARY LOAD
Engine corrected gross output includes the power required to drive standard equipment; lube oil, scavenge lube oil, fuel transfer, common rail fuel, separate circuit aftercooler and jacket water pumps. Engine net power available for the external (flywheel) load is calculated by subtracting the sum of auxiliary load from the corrected gross flywheel out put power. Typical auxiliary loads are radiator cooling fans, hydraulic pumps, air compressors and battery charging alternators. For Tier 4 ratings additional Parasitic losses would also include Intake, and Exhaust Restrictions.
ALTITUDE CAPABILITY
Altitude capability is the maximum altitude above sea level at standard temperature and standard pressure at which the engine could develop full rated output power on the current performance data set.
Standard temperature values versus altitude could be seen on TM2001.
When viewing the altitude capability chart the ambient temperature is the inlet air temp at the compressor inlet.
Engines with ADEM MEUI and HEUI fuel systems operating at conditions above the defined altitude capability derate for atmospheric pressure and temperature conditions outside the values defined, see TM2001.
Mechanical governor controlled unit injector engines require a setting change for operation at conditions above the altitude defined on the engine performance sheet. See your Caterpillar technical representative for non standard ratings.
REGULATIONS AND PRODUCT COMPLIANCE
TMI Emissions information is presented at 'nominal' and 'Potential Site Variation' values for standard ratings. No tolerances are applied to the emissions data. These values are subject to change at any time. The controlling federal and local emission requirements need to be verified by your Caterpillar technical representative.
Customer's may have special emission site requirements that need to be verified by the Caterpillar Product Group engineer.
EMISSION CYCLE LIMITS:
Cycle emissions Max Limits apply to cycle-weighted averages only. Emissions at individual load points may exceed the cycle-weighted limit.
WET & DRY EXHAUST/EMISSIONS DESCRIPTION:
Wet - Total exhaust flow or concentration of total exhaust flow
Dry - Total exhaust flow minus water vapor or concentration of exhaust flow with water vapor excluded
EMISSIONS DEFINITIONS:
Emissions : DM1176
EMISSION CYCLE DEFINITIONS
1. For constant-speed marine engines for ship main propulsion, including,diesel-electric drive, test cycle E2 shall be applied, for controllable-pitch propeller sets test cycle E2 shall be applied.
2. For propeller-law-operated main and propeller-law-operated auxiliary engines the test cycle E3 shall be applied.
3. For constant-speed auxiliary engines test cycle D2 shall be applied.
4. For variable-speed, variable-load auxiliary engines, not included above, test cycle C1 shall be applied.
HEAT REJECTION DEFINITIONS:
Diesel Circuit Type and HHV Balance : DM9500
HIGH DISPLACEMENT (HD) DEFINITIONS:
3500: EM1500
RATING DEFINITIONS:
Agriculture : TM6008
Fire Pump : TM6009
Generator Set : TM6035
Generator (Gas) : TM6041
Industrial Diesel : TM6010
Industrial (Gas) : TM6040
Irrigation : TM5749
Locomotive : TM6037
Marine Auxiliary : TM6036
Marine Prop (Except 3600) : TM5747
Marine Prop (3600 only) : TM5748
MSHA : TM6042
Oil Field (Petroleum) : TM6011
Off-Highway Truck : TM6039
On-Highway Truck : TM6038
SOUND DEFINITIONS:
Sound Power : DM8702
Sound Pressure : TM7080
Date Released : 10/27/21

Docusign Envelope ID: 9C8EC8DC-4C18-4394-A74F-E7CCFDDA6B5F

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PERFORMANCE DATA[EM1897]

August 7, 2025

Returned from Spider

Performance Number: EM1897

Change Level: 04

SALES MODEL:	3516C	**COMBUSTION:**	DIRECT INJECTION
BRAND:	CAT	**ENGINE SPEED (RPM):**	1,800
MACHINE SALES MODEL:		**HERTZ:**	60
ENGINE POWER (BHP):	2,937	**FAN POWER (HP):**	114.0
GEN POWER WITH FAN (EKW):	2,000.0	**ASPIRATION:**	TA
COMPRESSION RATIO:	14.7	**AFTERCOOLER TYPE:**	ATAAC
RATING LEVEL:	MISSION CRITICAL STANDBY	**AFTERCOOLER CIRCUIT TYPE:**	JW+OC, ATAAC
PUMP QUANTITY:	1	**INLET MANIFOLD AIR TEMP (F):**	122
FUEL TYPE:	DIESEL	**JACKET WATER TEMP (F):**	219.2
MANIFOLD TYPE:	DRY	**TURBO CONFIGURATION:**	PARALLEL
GOVERNOR TYPE:	ADEM3	**TURBO QUANTITY:**	4
ELECTRONICS TYPE:	ADEM3	**TURBOCHARGER MODEL:**	GTA5518BN-56T-1.12
CAMSHAFT TYPE:	STANDARD	**CERTIFICATION YEAR:**	2010
IGNITION TYPE:	CI	**CRANKCASE BLOWBY RATE (FT3/HR):**	2,937.9
INJECTOR TYPE:	EUI	**FUEL RATE (RATED RPM) NO LOAD (GAL/HR):**	13.6
FUEL INJECTOR:	3920220	**PISTON SPD @ RATED ENG SPD (FT/MIN):**	2,244.1
UNIT INJECTOR TIMING (IN):	64.34		
REF EXH STACK DIAMETER (IN):	12		
MAX OPERATING ALTITUDE (FT):	3,117		

INDUSTRY	SUBINDUSTRY	APPLICATION
ELECTRIC POWER	STANDARD	PACKAGED GENSET
OIL AND GAS	LAND PRODUCTION	PACKAGED GENSET

General Performance Data

THIS STANDBY RATING IS FOR A STANDBY ONLY ENGINE ARRANGEMENT. RERATING THE ENGINE TO A PRIME OR CONTINUOUS RATING IS NOT PERMITTED.

THE INLET MANIFOLD AIR TEMP LISTED IN THE HEADER, AND IN THE GENERAL PERFORMANCE DATA, IS THE AVERAGE INLET MANIFOLD TEMP FRONT TO REAR ON THE ENGINE.

GENSET POWER WITH FAN	PERCENT LOAD	ENGINE POWER	BRAKE MEAN EFF PRES (BMEP)	BRAKE SPEC FUEL CONSUMPTN (BSFC)	ISO BRAKE SPEC FUEL CONSUMPTN (BSFC)	VOL FUEL CONSUMPTN (VFC)	ISO VOL FUEL CONSUMPTN (VFC)	ELEC SPEC FUEL CONSUMPTN (ESFC)	ISO ELEC SPEC FUEL CONSUMPTN (ESFC)
EKW	%	BHP	PSI	LB/BHP-HR	LB/BHP-HR	GAL/HR	GAL/HR	LB/EKW-HR	LB/EKW-HR
2,000.0	100	2,937	307	0.329	0.323	136.2	133.6	0.483	0.474
1,800.0	90	2,641	276	0.331	0.325	123.3	120.9	0.486	0.477
1,700.0	85	2,496	261	0.334	0.327	117.3	115.1	0.490	0.480
1,600.0	80	2,353	246	0.337	0.330	111.6	109.5	0.495	0.486
1,500.0	75	2,212	231	0.340	0.334	106.1	104.1	0.502	0.492
1,400.0	70	2,071	216	0.344	0.338	100.5	98.6	0.509	0.500
1,200.0	60	1,795	188	0.352	0.345	88.9	87.3	0.526	0.516
1,000.0	50	1,521	159	0.357	0.350	76.5	75.1	0.543	0.533
800.0	40	1,250	131	0.357	0.350	62.9	61.7	0.558	0.547
600.0	30	977	102	0.365	0.358	50.2	49.3	0.594	0.583
500.0	25	839	88	0.374	0.367	44.2	43.4	0.628	0.616
400.0	20	699	73	0.388	0.381	38.3	37.5	0.678	0.666
200.0	10	411	43	0.450	0.441	26.1	25.6	0.926	0.908

GENSET POWER WITH FAN	PERCENT LOAD	ENGINE POWER	INLET MFLD PRES	INLET MFLD TEMP	EXH MFLD TEMP	EXH MFLD PRES	ENGINE OUTLET TEMP	COMPRESSOR OUTLET PRES	COMPRESSOR OUTLET TEMP
EKW	%	BHP	IN-HG	DEG F	DEG F	IN-HG	DEG F	IN-HG	DEG F
2,000.0	100	2,937	78.3	121.2	1,118.5	71.5	752.1	83	454.3
1,800.0	90	2,641	73.1	119.6	1,067.5	65.7	716.0	77	428.8
1,700.0	85	2,496	70.6	118.9	1,046.1	62.8	703.1	75	416.5
1,600.0	80	2,353	68.0	118.2	1,027.0	60.0	693.3	72	404.5
1,500.0	75	2,212	65.2	117.5	1,008.1	57.2	684.6	69	392.7
1,400.0	70	2,071	62.3	116.8	989.4	54.4	676.9	66	380.9
1,200.0	60	1,795	55.5	115.4	952.0	48.0	662.8	59	353.9
1,000.0	50	1,521	46.5	113.7	913.4	40.1	654.0	50	318.8
800.0	40	1,250	34.8	111.8	863.8	30.3	655.0	38	271.1
600.0	30	977	24.2	110.6	803.8	22.0	650.0	27	225.0
500.0	25	839	19.7	110.2	767.0	18.7	641.7	22	204.1
400.0	20	699	15.7	109.8	724.6	15.7	629.0	18	184.1
200.0	10	411	9.0	109.1	596.9	10.9	552.8	11	148.5

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PERFORMANCE DATA[EM1897]

August 7, 2025

General Performance Data (Continued)

GENSET POWER WITH FAN	PERCENT LOAD	ENGINE POWER	WET INLET AIR VOL FLOW RATE	ENGINE OUTLET WET EXH GAS VOL FLOW RATE	WET INLET AIR MASS FLOW RATE	WET EXH GAS MASS FLOW RATE	WET EXH VOL FLOW RATE (32 DEG F AND 29.98 IN HG)	DRY EXH VOL FLOW RATE (32 DEG F AND 29.98 IN HG)
EKW	%	BHP	CFM	CFM	LB/HR	LB/HR	FT3/MIN	FT3/MIN
2,000.0	100	2,937	6,548.9	15,292.8	28,512.8	29,478.4	6,205.0	5,738.7
1,800.0	90	2,641	6,318.7	14,243.0	27,390.5	28,264.7	5,956.5	5,533.7
1,700.0	85	2,496	6,200.9	13,769.3	26,822.2	27,655.6	5,822.0	5,419.7
1,600.0	80	2,353	6,073.3	13,331.0	26,220.6	27,012.9	5,685.0	5,301.6
1,500.0	75	2,212	5,932.2	12,897.9	25,568.0	26,319.7	5,542.0	5,176.6
1,400.0	70	2,071	5,777.2	12,448.0	24,862.1	25,573.8	5,384.8	5,037.5
1,200.0	60	1,795	5,397.2	11,422.5	23,141.0	23,771.1	5,003.4	4,694.0
1,000.0	50	1,521	4,857.3	10,138.7	20,731.5	21,274.5	4,476.2	4,208.4
800.0	40	1,250	4,090.0	8,488.8	17,357.1	17,803.6	3,744.5	3,524.2
600.0	30	977	3,394.1	6,989.6	14,328.5	14,684.4	3,097.0	2,920.6
500.0	25	839	3,103.5	6,328.1	13,075.2	13,388.4	2,825.1	2,668.8
400.0	20	699	2,840.4	5,696.0	11,947.2	12,218.4	2,572.5	2,435.7
200.0	10	411	2,409.4	4,478.2	10,105.7	10,290.7	2,174.6	2,076.8

Heat Rejection Data

GENSET POWER WITH FAN	PERCENT LOAD	ENGINE POWER	REJECTION TO JACKET WATER	REJECTION TO ATMOSPHERE	REJECTION TO EXH	EXHAUST RECOVERY TO 350F	FROM OIL COOLER	FROM AFTERCOOLER	WORK ENERGY	LOW HEAT VALUE ENERGY	HIGH HEAT VALUE ENERGY
EKW	%	BHP	BTU/MIN	BTU/MIN	BTU/MIN	BTU/MIN	BTU/MIN	BTU/MIN	BTU/MIN	BTU/MIN	BTU/MIN
2,000.0	100	2,937	43,150	7,564	101,696	49,615	15,778	38,240	124,558	296,234	315,563
1,800.0	90	2,641	40,179	7,175	92,069	43,106	14,280	34,105	111,977	268,102	285,596
1,700.0	85	2,496	38,776	7,030	87,977	40,623	13,590	32,133	105,834	255,144	271,792
1,600.0	80	2,353	37,427	6,907	84,225	38,510	12,931	30,201	99,774	242,774	258,615
1,500.0	75	2,212	36,092	6,791	80,632	36,523	12,286	28,303	93,784	230,664	245,715
1,400.0	70	2,071	34,737	6,671	77,064	34,629	11,640	26,432	87,835	218,548	232,809
1,200.0	60	1,795	31,877	6,341	69,432	30,722	10,302	22,179	76,103	193,426	206,048
1,000.0	50	1,521	28,631	6,026	60,835	26,675	8,865	17,129	64,508	166,434	177,294
800.0	40	1,250	24,910	5,810	50,784	22,387	7,288	11,280	53,005	136,837	145,766
600.0	30	977	21,252	5,496	41,420	18,139	5,820	6,677	41,431	109,268	116,397
500.0	25	839	19,405	5,303	37,082	16,055	5,124	4,986	35,574	96,210	102,488
400.0	20	699	17,492	5,098	32,738	13,986	4,431	3,593	29,634	83,193	88,622
200.0	10	411	13,286	4,670	23,481	8,473	3,022	1,516	17,448	56,745	60,447

Sound Data

EXHAUST:SOUND PRESSURE(OBCF) DISTANCE:1.5 METER

GENSET POWER WITH FAN	PERCENT LOAD	ENGINE POWER	OVERALL SOUND	63 HZ	125 HZ	250 HZ	500 HZ
EKW	%	BHP	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)
2,000.0	100	2,937	117.0	107.0	122.0	118.0	110.0
1,800.0	90	2,641	116.0	106.0	121.0	117.0	109.0
1,700.0	85	2,496	115.0	105.0	120.0	116.0	108.0
1,600.0	80	2,353	115.0	105.0	120.0	116.0	108.0
1,500.0	75	2,212	114.0	104.0	119.0	115.0	107.0
1,400.0	70	2,071	114.0	104.0	119.0	115.0	107.0
1,200.0	60	1,795	112.0	103.0	117.0	113.0	105.0
1,000.0	50	1,521	111.0	101.0	116.0	112.0	104.0
800.0	40	1,250	110.0	100.0	115.0	111.0	103.0
600.0	30	977	108.0	99.0	113.0	109.0	101.0
500.0	25	839	108.0	98.0	113.0	109.0	101.0
400.0	20	699	107.0	97.0	112.0	108.0	100.0
200.0	10	411	104.0	95.0	109.0	105.0	97.0

Docusign Envelope ID: 9C8EC8DC-4C18-4394-A74F-E7CCFDDA6B5F

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PERFORMANCE DATA[EM1897]

August 7, 2025

EXHAUST:SOUND PRESSURE(OBCF) DISTANCE:1.5 METER

GENSET POWER WITH FAN	PERCENT LOAD	ENGINE POWER	1000 HZ	2000 HZ	4000 HZ	8000 HZ
EKW	%	BHP	dB(A)	dB(A)	dB(A)	dB(A)
2,000.0	100	2,937	108.0	109.0	109.0	107.0
1,800.0	90	2,641	107.0	108.0	108.0	106.0
1,700.0	85	2,496	107.0	108.0	108.0	106.0
1,600.0	80	2,353	106.0	107.0	107.0	105.0
1,500.0	75	2,212	106.0	107.0	107.0	105.0
1,400.0	70	2,071	105.0	106.0	106.0	104.0
1,200.0	60	1,795	104.0	105.0	105.0	103.0
1,000.0	50	1,521	103.0	104.0	104.0	102.0
800.0	40	1,250	101.0	103.0	102.0	101.0
600.0	30	977	100.0	101.0	101.0	99.0
500.0	25	839	99.0	100.0	100.0	98.0
400.0	20	699	98.0	99.0	99.0	97.0
200.0	10	411	96.0	97.0	97.0	95.0

EXHAUST:SOUND PRESSURE(OBCF) DISTANCE:7 METER

GENSET POWER WITH FAN	PERCENT LOAD	ENGINE POWER	OVERALL SOUND	63 HZ	125 HZ	250 HZ	500 HZ
EKW	%	BHP	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)
2,000.0	100	2,937	103.0	95.0	111.0	105.0	97.0
1,800.0	90	2,641	102.0	94.0	110.0	104.0	96.0
1,700.0	85	2,496	102.0	93.0	110.0	104.0	95.0
1,600.0	80	2,353	101.0	93.0	109.0	103.0	95.0
1,500.0	75	2,212	101.0	92.0	109.0	103.0	94.0
1,400.0	70	2,071	100.0	92.0	108.0	102.0	94.0
1,200.0	60	1,795	99.0	90.0	107.0	101.0	93.0
1,000.0	50	1,521	98.0	89.0	106.0	100.0	91.0
800.0	40	1,250	96.0	88.0	104.0	99.0	90.0
600.0	30	977	95.0	86.0	103.0	97.0	89.0
500.0	25	839	94.0	86.0	102.0	96.0	88.0
400.0	20	699	93.0	85.0	101.0	95.0	87.0
200.0	10	411	91.0	83.0	99.0	93.0	85.0

EXHAUST:SOUND PRESSURE(OBCF) DISTANCE:7 METER

GENSET POWER WITH FAN	PERCENT LOAD	ENGINE POWER	1000 HZ	2000 HZ	4000 HZ	8000 HZ
EKW	%	BHP	dB(A)	dB(A)	dB(A)	dB(A)
2,000.0	100	2,937	95.0	96.0	96.0	93.0
1,800.0	90	2,641	94.0	95.0	95.0	92.0
1,700.0	85	2,496	94.0	94.0	94.0	92.0
1,600.0	80	2,353	93.0	94.0	94.0	91.0
1,500.0	75	2,212	93.0	93.0	93.0	90.0
1,400.0	70	2,071	92.0	93.0	93.0	90.0
1,200.0	60	1,795	91.0	92.0	92.0	89.0
1,000.0	50	1,521	90.0	90.0	90.0	88.0
800.0	40	1,250	88.0	89.0	89.0	86.0
600.0	30	977	87.0	88.0	88.0	85.0
500.0	25	839	86.0	87.0	87.0	84.0
400.0	20	699	85.0	86.0	86.0	83.0
200.0	10	411	83.0	84.0	84.0	81.0

EXHAUST:SOUND PRESSURE(OBCF) DISTANCE:15 METER

GENSET POWER WITH FAN	PERCENT LOAD	ENGINE POWER	OVERALL SOUND	63 HZ	125 HZ	250 HZ	500 HZ
EKW	%	BHP	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)
2,000.0	100	2,937	97.0	88.0	105.0	99.0	90.0
1,800.0	90	2,641	96.0	87.0	104.0	98.0	89.0
1,700.0	85	2,496	95.0	87.0	103.0	97.0	89.0
1,600.0	80	2,353	95.0	86.0	103.0	97.0	88.0

Docusign Envelope ID: 9C8EC8DC-4C18-4394-A74F-E7CCFDDA6B5F

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PERFORMANCE DATA[EM1897]

1,500.0	75	2,212	94.0	85.0	102.0	96.0	88.0
1,400.0	70	2,071	94.0	85.0	102.0	96.0	87.0
1,200.0	60	1,795	92.0	84.0	100.0	95.0	86.0
1,000.0	50	1,521	91.0	83.0	99.0	93.0	85.0
800.0	40	1,250	90.0	81.0	98.0	92.0	83.0
600.0	30	977	88.0	80.0	96.0	91.0	82.0
500.0	25	839	88.0	79.0	96.0	90.0	81.0
400.0	20	699	87.0	78.0	95.0	89.0	80.0
200.0	10	411	84.0	76.0	92.0	87.0	78.0

EXHAUST:SOUND PRESSURE(OBCF) DISTANCE:15 METER

GENSET POWER WİTH FAN	PERCENT LOAD	ENGİNE POWER	1000 HZ	2000 HZ	4000 HZ	8000 HZ
EKW	%	BHP	dB(A)	dB(A)	dB(A)	dB(A)
2,000.0	100	2,937	89.0	89.0	89.0	86.0
1,800.0	90	2,641	88.0	88.0	88.0	85.0
1,700.0	85	2,496	87.0	88.0	88.0	85.0
1,600.0	80	2,353	87.0	87.0	87.0	84.0
1,500.0	75	2,212	86.0	87.0	87.0	84.0
1,400.0	70	2,071	86.0	86.0	86.0	83.0
1,200.0	60	1,795	84.0	85.0	85.0	82.0
1,000.0	50	1,521	83.0	84.0	84.0	81.0
800.0	40	1,250	82.0	83.0	82.0	80.0
600.0	30	977	80.0	81.0	81.0	78.0
500.0	25	839	80.0	80.0	80.0	77.0
400.0	20	699	79.0	79.0	79.0	76.0
200.0	10	411	76.0	77.0	77.0	74.0

MECHANICAL:SOUND PRESSURE(OBCF) DISTANCE:1 METER

GENSET POWER WİTH FAN	PERCENT LOAD	ENGİNE POWER	OVERALL SOUND	63 HZ	125 HZ	250 HZ	500 HZ
EKW	%	BHP	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)
2,000.0	100	2,937	105.0	92.0	100.0	101.0	99.0
1,800.0	90	2,641	105.0	92.0	100.0	101.0	99.0
1,700.0	85	2,496	105.0	92.0	100.0	101.0	99.0
1,600.0	80	2,353	105.0	92.0	100.0	101.0	99.0
1,500.0	75	2,212	105.0	92.0	100.0	101.0	99.0
1,400.0	70	2,071	105.0	92.0	100.0	101.0	99.0
1,200.0	60	1,795	105.0	92.0	100.0	101.0	99.0
1,000.0	50	1,521	105.0	92.0	100.0	101.0	99.0
800.0	40	1,250	105.0	92.0	100.0	101.0	99.0
600.0	30	977	105.0	92.0	100.0	101.0	99.0
500.0	25	839	105.0	92.0	100.0	101.0	99.0
400.0	20	699	105.0	92.0	100.0	101.0	99.0
200.0	10	411	105.0	92.0	100.0	101.0	99.0

MECHANICAL:SOUND PRESSURE(OBCF) DISTANCE:1 METER

GENSET POWER WİTH FAN	PERCENT LOAD	ENGİNE POWER	1000 HZ	2000 HZ	4000 HZ	8000 HZ
EKW	%	BHP	dB(A)	dB(A)	dB(A)	dB(A)
2,000.0	100	2,937	100.0	101.0	99.0	103.0
1,800.0	90	2,641	100.0	101.0	99.0	103.0
1,700.0	85	2,496	100.0	101.0	99.0	103.0
1,600.0	80	2,353	100.0	101.0	99.0	103.0
1,500.0	75	2,212	100.0	101.0	99.0	103.0
1,400.0	70	2,071	100.0	101.0	99.0	103.0
1,200.0	60	1,795	100.0	101.0	99.0	103.0
1,000.0	50	1,521	100.0	101.0	99.0	103.0
800.0	40	1,250	100.0	101.0	99.0	103.0
600.0	30	977	100.0	101.0	99.0	103.0
500.0	25	839	100.0	101.0	99.0	103.0
400.0	20	699	100.0	101.0	99.0	103.0
200.0	10	411	100.0	101.0	99.0	103.0

MECHANICAL:SOUND PRESSURE(OBCF) DISTANCE:7 METER

Docusign Envelope ID: 9C8EC8DC-4C18-4394-A74F-E7CCFDDA6B5F

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PERFORMANCE DATA[EM1897]

August 7, 2025

GENSET POWER WITH FAN	PERCENT LOAD	ENGINE POWER	OVERALL SOUND	63 HZ	125 HZ	250 HZ	500 HZ
EKW	%	BHP	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)
2,000.0	100	2,937	94.0	81.0	88.0	89.0	87.0
1,800.0	90	2,641	94.0	81.0	88.0	89.0	87.0
1,700.0	85	2,496	94.0	81.0	88.0	89.0	87.0
1,600.0	80	2,353	94.0	81.0	88.0	89.0	87.0
1,500.0	75	2,212	94.0	81.0	88.0	89.0	87.0
1,400.0	70	2,071	94.0	81.0	88.0	89.0	87.0
1,200.0	60	1,795	94.0	81.0	88.0	89.0	87.0
1,000.0	50	1,521	94.0	81.0	88.0	89.0	87.0
800.0	40	1,250	94.0	81.0	88.0	89.0	87.0
600.0	30	977	94.0	81.0	88.0	89.0	87.0
500.0	25	839	94.0	81.0	88.0	89.0	87.0
400.0	20	699	94.0	81.0	88.0	89.0	87.0
200.0	10	411	94.0	81.0	88.0	89.0	87.0

MECHANICAL:SOUND PRESSURE(OBCF) DISTANCE:7 METER

GENSET POWER WITH FAN	PERCENT LOAD	ENGINE POWER	1000 HZ	2000 HZ	4000 HZ	8000 HZ
EKW	%	BHP	dB(A)	dB(A)	dB(A)	dB(A)
2,000.0	100	2,937	89.0	90.0	87.0	91.0
1,800.0	90	2,641	89.0	90.0	87.0	91.0
1,700.0	85	2,496	89.0	90.0	87.0	91.0
1,600.0	80	2,353	89.0	90.0	87.0	91.0
1,500.0	75	2,212	89.0	90.0	87.0	91.0
1,400.0	70	2,071	89.0	90.0	87.0	91.0
1,200.0	60	1,795	89.0	90.0	87.0	91.0
1,000.0	50	1,521	89.0	90.0	87.0	91.0
800.0	40	1,250	89.0	90.0	87.0	91.0
600.0	30	977	89.0	90.0	87.0	91.0
500.0	25	839	89.0	90.0	87.0	91.0
400.0	20	699	89.0	90.0	87.0	91.0
200.0	10	411	89.0	90.0	87.0	91.0

MECHANICAL:SOUND PRESSURE(OBCF) DISTANCE:15 METER

GENSET POWER WITH FAN	PERCENT LOAD	ENGINE POWER	OVERALL SOUND	63 HZ	125 HZ	250 HZ	500 HZ
EKW	%	BHP	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)
2,000.0	100	2,937	88.0	76.0	83.0	84.0	82.0
1,800.0	90	2,641	88.0	76.0	83.0	84.0	82.0
1,700.0	85	2,496	88.0	76.0	83.0	84.0	82.0
1,600.0	80	2,353	88.0	76.0	83.0	84.0	82.0
1,500.0	75	2,212	88.0	76.0	83.0	84.0	82.0
1,400.0	70	2,071	88.0	76.0	83.0	84.0	82.0
1,200.0	60	1,795	88.0	76.0	83.0	84.0	82.0
1,000.0	50	1,521	88.0	76.0	83.0	84.0	82.0
800.0	40	1,250	88.0	76.0	83.0	84.0	82.0
600.0	30	977	88.0	76.0	83.0	84.0	82.0
500.0	25	839	88.0	76.0	83.0	84.0	82.0
400.0	20	699	88.0	76.0	83.0	84.0	82.0
200.0	10	411	88.0	76.0	83.0	84.0	82.0

MECHANICAL:SOUND PRESSURE(OBCF) DISTANCE:15 METER

GENSET POWER WITH FAN	PERCENT LOAD	ENGINE POWER	1000 HZ	2000 HZ	4000 HZ	8000 HZ
EKW	%	BHP	dB(A)	dB(A)	dB(A)	dB(A)
2,000.0	100	2,937	83.0	84.0	82.0	86.0
1,800.0	90	2,641	83.0	84.0	82.0	86.0
1,700.0	85	2,496	83.0	84.0	82.0	86.0
1,600.0	80	2,353	83.0	84.0	82.0	86.0
1,500.0	75	2,212	83.0	84.0	82.0	86.0
1,400.0	70	2,071	83.0	84.0	82.0	86.0
1,200.0	60	1,795	83.0	84.0	82.0	86.0
1,000.0	50	1,521	83.0	84.0	82.0	86.0
800.0	40	1,250	83.0	84.0	82.0	86.0

Docusign Envelope ID: 9C8EC8DC-4C18-4394-A74F-E7CCFDDA6B5F

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600.0	30	977	83.0	84.0	82.0	86.0
500.0	25	839	83.0	84.0	82.0	86.0
400.0	20	699	83.0	84.0	82.0	86.0
200.0	10	411	83.0	84.0	82.0	86.0

Emissions Data

DIESEL

RATED SPEED NOMINAL DATA: 1800 RPM

GENSET POWER WITH FAN		EKW	2,000.0	1,700.0	1,500.0	1,000.0	500.0	200.0
PERCENT LOAD		%	100	85	75	50	25	10
ENGINE POWER		BHP	2,937	2,496	2,212	1,521	839	411
TOTAL NOX (AS NO2)		G/HR	16,047	11,259	8,598	4,842	3,518	2,444
TOTAL CO		G/HR	878	608	474	497	985	996
TOTAL HC		G/HR	317	395	386	385	308	333
TOTAL CO2		KG/HR	1,393	1,192	1,073	765	430	250
PART MATTER		G/HR	75.3	71.3	71.0	87.5	183.4	145.2
TOTAL NOX (AS NO2)	(CORR 5% O2)	MG/NM3	2,754.3	2,262.3	1,944.8	1,541.2	1,982.3	2,379.2
TOTAL CO	(CORR 5% O2)	MG/NM3	143.3	115.8	101.0	151.4	497.5	952.4
TOTAL HC	(CORR 5% O2)	MG/NM3	44.7	65.4	70.3	99.0	145.9	285.0
PART MATTER	(CORR 5% O2)	MG/NM3	10.4	11.8	13.1	24.6	85.6	115.2
TOTAL NOX (AS NO2)	(CORR 15% O2)	MG/NM3	1,022.0	839.5	721.7	571.9	735.6	882.9
TOTAL CO	(CORR 15% O2)	MG/NM3	53.2	43.0	37.5	56.2	184.6	353.4
TOTAL HC	(CORR 15% O2)	MG/NM3	16.6	24.3	26.1	36.7	54.2	105.8
PART MATTER	(CORR 15% O2)	MG/NM3	3.9	4.4	4.9	9.1	31.8	42.7
TOTAL NOX (AS NO2)	(CORR 5% O2)	PPM	1,342	1,102	947	751	966	1,159
TOTAL CO	(CORR 5% O2)	PPM	115	93	81	121	398	762
TOTAL HC	(CORR 5% O2)	PPM	83	122	131	185	272	532
TOTAL NOX (AS NO2)	(CORR 15% O2)	PPM	498	409	352	279	358	430
TOTAL CO	(CORR 15% O2)	PPM	43	34	30	45	148	283
TOTAL HC	(CORR 15% O2)	PPM	31	45	49	69	101	197
TOTAL NOX (AS NO2)		G/HP-HR	5.46	4.51	3.89	3.18	4.19	5.94
TOTAL CO		G/HP-HR	0.30	0.24	0.21	0.33	1.17	2.42
TOTAL HC		G/HP-HR	0.11	0.16	0.17	0.25	0.37	0.81
PART MATTER		G/HP-HR	0.03	0.03	0.03	0.06	0.22	0.35
TOTAL NOX (AS NO2)		G/KW-HR	7.33	6.05	5.21	4.27	5.62	7.97
TOTAL CO		G/KW-HR	0.40	0.33	0.29	0.44	1.57	3.25
TOTAL HC		G/KW-HR	0.14	0.21	0.23	0.34	0.49	1.08
PART MATTER		G/KW-HR	0.03	0.04	0.04	0.08	0.29	0.47
TOTAL NOX (AS NO2)		LB/HR	35.38	24.82	18.96	10.68	7.76	5.39
TOTAL CO		LB/HR	1.94	1.34	1.05	1.09	2.17	2.20
TOTAL HC		LB/HR	0.70	0.87	0.85	0.85	0.68	0.73
TOTAL CO2		LB/HR	3,070	2,627	2,365	1,687	949	552
PART MATTER		LB/HR	0.17	0.16	0.16	0.19	0.40	0.32
OXYGEN IN EXH		%	10.8	11.7	12.3	13.3	14.2	15.8
DRY SMOKE OPACITY		%	0.0	0.0	0.0	1.0	3.9	3.2
BOSCH SMOKE NUMBER			0.65	0.67	0.68	0.77	1.12	1.06

RATED SPEED POTENTIAL SITE VARIATION: 1800 RPM

GENSET POWER WITH FAN		EKW	2,000.0	1,700.0	1,500.0	1,000.0	500.0	200.0
PERCENT LOAD		%	100	85	75	50	25	10
ENGINE POWER		BHP	2,937	2,496	2,212	1,521	839	411
TOTAL NOX (AS NO2)		G/HR	19,256	13,510	10,318	5,811	4,222	2,933
TOTAL CO		G/HR	1,581	1,095	854	894	1,773	1,794

Docusign Envelope ID: 9C8EC8DC-4C18-4394-A74F-E7CCFDDA6B5F

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August 7, 2025

TOTAL HC		G/HR	422	526	514	512	410	442
PART MATTER		G/HR	105.4	99.8	99.5	122.5	256.7	203.2
TOTAL NOX (AS NO2)	(CORR 5% O2)	MG/NM3	3,305.2	2,714.8	2,333.8	1,849.4	2,378.8	2,855.1
TOTAL CO	(CORR 5% O2)	MG/NM3	258.0	208.4	181.8	272.6	895.6	1,714.4
TOTAL HC	(CORR 5% O2)	MG/NM3	59.5	87.0	93.5	131.7	194.1	379.0
PART MATTER	(CORR 5% O2)	MG/NM3	14.6	16.5	18.4	34.4	119.9	161.2
TOTAL NOX (AS NO2)	(CORR 15% O2)	MG/NM3	1,226.5	1,007.4	866.0	686.3	882.7	1,059.4
TOTAL CO	(CORR 15% O2)	MG/NM3	95.7	77.3	67.5	101.1	332.3	636.2
TOTAL HC	(CORR 15% O2)	MG/NM3	22.1	32.3	34.7	48.9	72.0	140.7
PART MATTER	(CORR 15% O2)	MG/NM3	5.4	6.1	6.8	12.8	44.5	59.8
TOTAL NOX (AS NO2)	(CORR 5% O2)	PPM	1,610	1,322	1,137	901	1,159	1,391
TOTAL CO	(CORR 5% O2)	PPM	206	167	145	218	716	1,371
TOTAL HC	(CORR 5% O2)	PPM	111	162	175	246	362	708
TOTAL NOX (AS NO2)	(CORR 15% O2)	PPM	597	491	422	334	430	516
TOTAL CO	(CORR 15% O2)	PPM	77	62	54	81	266	509
TOTAL HC	(CORR 15% O2)	PPM	41	60	65	91	134	263
TOTAL NOX (AS NO2)		G/HP-HR	6.56	5.41	4.67	3.82	5.03	7.13
TOTAL CO		G/HP-HR	0.54	0.44	0.39	0.59	2.11	4.36
TOTAL HC		G/HP-HR	0.14	0.21	0.23	0.34	0.49	1.08
PART MATTER		G/HP-HR	0.04	0.04	0.04	0.08	0.31	0.49
TOTAL NOX (AS NO2)		G/KW-HR	8.79	7.26	6.26	5.12	6.75	9.56
TOTAL CO		G/KW-HR	0.72	0.59	0.52	0.79	2.83	5.85
TOTAL HC		G/KW-HR	0.19	0.28	0.31	0.45	0.65	1.44
PART MATTER		G/KW-HR	0.05	0.05	0.06	0.11	0.41	0.66
TOTAL NOX (AS NO2)		LB/HR	42.45	29.78	22.75	12.81	9.31	6.47
TOTAL CO		LB/HR	3.48	2.41	1.88	1.97	3.91	3.95
TOTAL HC		LB/HR	0.93	1.16	1.13	1.13	0.90	0.98
PART MATTER		LB/HR	0.23	0.22	0.22	0.27	0.57	0.45

Regulatory Information

EPA EMERGENCY STATIONARY			2011 - ----	
GASEOUS EMISSIONS DATA MEASUREMENTS PROVIDED TO THE EPA ARE CONSISTENT WITH THOSE DESCRIBED IN EPA 40 CFR PART 60 SUBPART IIII AND ISO 8178 FOR MEASURING HC, CO, PM, AND NOX. THE "MAX LIMITS" SHOWN BELOW ARE WEIGHTED CYCLE AVERAGES AND ARE IN COMPLIANCE WITH THE EMERGENCY STATIONARY REGULATIONS.				
Locality	**Agency**	**Regulation**	**Tier/Stage**	**Max Limits - G/BKW - HR**
U.S. (INCL CALIF)	EPA	STATIONARY	EMERGENCY STATIONARY	CO: 3.5 NOx + HC: 6.4 PM: 0.20

Altitude Derate Data

STANDARD

ALTITUDE CORRECTED POWER CAPABILITY (BHP)

AMBIENT OPERATING TEMP (F)	30	40	50	60	70	80	90	100	110	120	130	140	NORMAL
ALTITUDE (FT)													
0	2,937	2,937	2,937	2,937	2,937	2,937	2,937	2,937	2,937	2,937	2,849	2,731	2,937
1,000	2,937	2,937	2,937	2,937	2,937	2,937	2,937	2,937	2,937	2,931	2,820	2,702	2,937
2,000	2,937	2,937	2,937	2,937	2,937	2,937	2,937	2,927	2,876	2,826	2,761	2,614	2,937
3,000	2,937	2,937	2,937	2,937	2,937	2,926	2,873	2,822	2,772	2,724	2,673	2,526	2,937
4,000	2,849	2,849	2,849	2,849	2,849	2,820	2,768	2,719	2,671	2,625	2,581	2,467	2,849
5,000	2,752	2,752	2,752	2,752	2,752	2,716	2,667	2,619	2,573	2,529	2,486	2,350	2,752
6,000	2,659	2,659	2,659	2,659	2,659	2,616	2,569	2,523	2,478	2,436	2,379	2,261	2,659
7,000	2,570	2,570	2,570	2,570	2,567	2,519	2,473	2,429	2,386	2,345	2,261	2,144	2,570
8,000	2,484	2,484	2,484	2,484	2,471	2,425	2,381	2,338	2,297	2,257	2,144	1,968	2,484
9,000	2,401	2,401	2,401	2,401	2,377	2,333	2,291	2,250	2,211	2,172	1,997	1,792	2,401
10,000	2,321	2,321	2,321	2,321	2,287	2,245	2,204	2,165	2,127	1,997	1,792	1,586	2,321
11,000	2,244	2,244	2,244	2,242	2,200	2,159	2,120	2,082	2,027	1,821	1,615	1,439	2,244

Docusign Envelope ID: 9C8EC8DC-4C18-4394-A74F-E7CCFDDA6B5F

RECEIVED 11/17/2025

PERFORMANCE DATA[EM1897]

12,000	2,171	2,171	2,171	2,156	2,115	2,076	2,038	1,997	1,821	1,615	1,439	1,292	2,171
13,000	2,100	2,100	2,100	2,072	2,033	1,995	1,959	1,850	1,645	1,439	1,292	1,175	2,100
14,000	2,027	2,027	2,027	1,991	1,954	1,917	1,821	1,645	1,469	1,322	1,175	1,028	2,027
15,000	1,938	1,938	1,938	1,913	1,877	1,792	1,674	1,469	1,322	1,175	1,057	940	1,938

Cross Reference

Test Spec	Setting	Engine Arrangement	Engineering Model	Engineering Model Version	Start Effective Serial Number	End Effective Serial Number
4577178	LL1860	5084279	GS334	-	SBJ02000	
4581558	LL6753	5157719	PG237	-	LY500001	

Performance Parameter Reference

Parameters Reference:DM9600-15

PERFORMANCE DEFINITIONS

PERFORMANCE DEFINITIONS DM9600
APPLICATION:
Engine performance tolerance values below are representative of a typical production engine tested in a calibrated dynamometer test cell at SAE J1995 standard reference conditions. Caterpillar maintains ISO9001:2000 certified quality management systems for engine test Facilities to assure accurate calibration of test equipment. Engine test data is corrected in accordance with SAE J1995. Additional reference material SAE J1228, J1349, ISO 8665, 3046-1:2002E, 3046-3:1989, 1585, 2534, 2288, and 9249 may apply in part or are similar to SAE J1995. Special engine rating request (SERR) test data shall be noted.
PERFORMANCE PARAMETER TOLERANCE FACTORS:
Power +/- 3%
Torque +/- 3%
Exhaust stack temperature +/- 8%
Inlet airflow +/- 5%
Intake manifold pressure-gage +/- 10%
Exhaust flow +/- 6%
Specific fuel consumption +/- 3%
Specific fuel consumption (C7-C18) +/- 4%
Fuel rate +/- 5%
Specific DEF consumption +/- 3%
DEF rate +/- 5%
Heat rejection +/- 5%
Heat rejection exhaust only +/- 10%
Heat rejection CEM only +/- 10%
Heat Rejection values based on using treated water.
Torque is included for truck and industrial applications, do not use for Gen Set or steady state applications.
On C7 - C18 engines, at speeds of 1100 RPM and under these values are provided for reference only, and may not meet the tolerance listed.
On 3500 and C175 engines, at speeds below Peak Torque these values are provided for reference only, and may not meet the tolerance listed.
These values do not apply to C280/3600. For these models, see the tolerances listed below.
C280/3600 HEAT REJECTION TOLERANCE FACTORS:
Heat rejection +/- 10%
Heat rejection to Atmosphere +/- 50%
Heat rejection to Lube Oil +/- 20%
Heat rejection to Aftercooler +/- 5%
TEST CELL TRANSDUCER TOLERANCE FACTORS:
Torque +/- 0.5%
Speed +/- 0.2%
Fuel flow +/- 1.0%
Temperature +/- 2.0 C degrees
Intake manifold pressure +/- 0.1 kPa
OBSERVED ENGINE PERFORMANCE IS CORRECTED TO SAE J1995 REFERENCE
AIR AND FUEL CONDITIONS.
REFERENCE ATMOSPHERIC INLET AIR
FOR 3500 ENGINES AND SMALLER
SAE J1228 AUG2002 for marine engines, and J1995 JAN2014 for other engines, reference atmospheric pressure is 100 KPA (29.61 in hg), and standard temperature is 25deg C (77 deg F) at 30% relative humidity at the stated aftercooler water temp, or inlet manifold temp.
FOR 3600 ENGINES
Engine rating obtained and presented in accordance with ISO 3046/1

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PERFORMANCE DATA[EM1897]

and SAE J1995 JANJAN2014 reference atmospheric pressure is 100 KPA (29.61 in hg), and standard temperature is 25deg C (77 deg F) at 30% relative humidity and 150M altitude at the stated aftercooler water temperature.

MEASUREMENT LOCATION FOR INLET AIR TEMPERATURE

Location for air temperature measurement air cleaner inlet at stabilized operating conditions.

REFERENCE EXHAUST STACK DIAMETER

The Reference Exhaust Stack Diameter published with this dataset is only used for the calculation of Smoke Opacity values displayed in this dataset. This value does not necessarily represent the actual stack diameter of the engine due to the variety of exhaust stack adapter options available. Consult the price list, engine order or general dimension drawings for the actual stack diameter size ordered or options available.

REFERENCE FUEL

DIESEL

Reference fuel is #2 distillate diesel with a 35API gravity;
A lower heating value is 42,780 KJ/KG (18,390 BTU/LB) when used at 15 deg C (59 deg F), where the density is
850 G/Liter (7.0936 Lbs/Gal).

GAS

Reference natural gas fuel has a lower heating value of 33.74 KJ/L (905 BTU/CU Ft). Low BTU ratings are based on 18.64 KJ/L (500 BTU/CU FT) lower heating value gas. Propane ratings are based on 87.56 KJ/L (2350 BTU/CU Ft) lower heating value gas.

ENGINE POWER (NET) IS THE CORRECTED FLYWHEEL POWER (GROSS) LESS

EXTERNAL AUXILIARY LOAD

Engine corrected gross output includes the power required to drive standard equipment; lube oil, scavenge lube oil, fuel transfer, common rail fuel, separate circuit aftercooler and jacket water pumps. Engine net power available for the external (flywheel) load is calculated by subtracting the sum of auxiliary load from the corrected gross flywheel out put power. Typical auxiliary loads are radiator cooling fans, hydraulic pumps, air compressors and battery charging alternators. For Tier 4 ratings additional Parasitic losses would also include Intake, and Exhaust Restrictions.

ALTITUDE CAPABILITY

Altitude capability is the maximum altitude above sea level at standard temperature and standard pressure at which the engine could develop full rated output power on the current performance data set.

Standard temperature values versus altitude could be seen on TM2001.

When viewing the altitude capability chart the ambient temperature is the inlet air temp at the compressor inlet.

Engines with ADEM MEUI and HEUI fuel systems operating at conditions above the defined altitude capability derate for atmospheric pressure and temperature conditions outside the values defined, see TM2001.

Mechanical governor controlled unit injector engines require a setting change for operation at conditions above the altitude defined on the engine performance sheet. See your Caterpillar technical representative for non standard ratings.

REGULATIONS AND PRODUCT COMPLIANCE

TMI Emissions information is presented at 'nominal' and 'Potential Site Variation' values for standard ratings. No tolerances are applied to the emissions data. These values are subject to change at any time. The controlling federal and local emission requirements need to be verified by your Caterpillar technical representative.

Customer's may have special emission site requirements that need to be verified by the Caterpillar Product Group engineer.

EMISSION CYCLE LIMITS:

Cycle emissions Max Limits apply to cycle-weighted averages only. Emissions at individual load points may exceed the cycle-weighted limit.

WET & DRY EXHAUST/EMISSIONS DESCRIPTION:

Wet - Total exhaust flow or concentration of total exhaust flow
Dry - Total exhaust flow minus water vapor or concentration of exhaust flow with water vapor excluded

EMISSIONS DEFINITIONS:

Emissions : DM1176

EMISSION CYCLE DEFINITIONS

1. For constant-speed marine engines for ship main propulsion, including,diesel-electric drive, test cycle E2 shall be applied, for controllable-pitch propeller sets
test cycle E2 shall be applied.
2. For propeller-law-operated main and propeller-law-operated auxiliary engines the test cycle E3 shall be applied.
3. For constant-speed auxiliary engines test cycle D2 shall be applied.
4. For variable-speed, variable-load auxiliary engines, not included above, test cycle C1 shall be applied.

HEAT REJECTION DEFINITIONS:

Diesel Circuit Type and HHV Balance : DM9500

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PERFORMANCE DATA[EM1897]

August 7, 2025

HIGH DISPLACEMENT (HD) DEFINITIONS:
3500: EM1500
RATING DEFINITIONS:
Agriculture : TM6008
Fire Pump : TM6009
Generator Set : TM6035
Generator (Gas) : TM6041
Industrial Diesel : TM6010
Industrial (Gas) : TM6040
Irrigation : TM5749
Locomotive : TM6037
Marine Auxiliary : TM6036
Marine Prop (Except 3600) : TM5747
Marine Prop (3600 only) : TM5748
MSHA : TM6042
Oil Field (Petroleum) : TM6011
Off-Highway Truck : TM6039
On-Highway Truck : TM6038
SOUND DEFINITIONS:
Sound Power : DM8702
Sound Pressure : TM7080
Date Released : 03/12/24

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PERFORMANCE DATA[EM5402]

January 30, 2023

Ready for Spider

Performance Number: EM5402

Change Level: 01

SALES MODEL:	3516E	**COMBUSTION:**	DIRECT INJECTION
BRAND:	CAT	**ENGINE SPEED (RPM):**	1,800
MACHINE SALES MODEL:		**HERTZ:**	60
ENGINE POWER (BHP):	4,043	**FAN POWER (HP):**	160.9
GEN POWER WITH FAN (EKW):	2,750.0	**ASPIRATION:**	TA
COMPRESSION RATIO:	14.7	**AFTERCOOLER TYPE:**	ATAAC
RATING LEVEL:	MISSION CRITICAL STANDBY	**AFTERCOOLER CIRCUIT TYPE:**	JW+OC, ATAAC
PUMP QUANTITY:	1	**INLET MANIFOLD AIR TEMP (F):**	122
FUEL TYPE:	DIESEL	**JACKET WATER TEMP (F):**	219.2
MANIFOLD TYPE:	DRY	**TURBO CONFIGURATION:**	PARALLEL
GOVERNOR TYPE:	ADEM5	**TURBO QUANTITY:**	4
ELECTRONICS TYPE:	ADEM5	**TURBOCHARGER MODEL:**	GTB6051N-44T-1.25
IGNITION TYPE:	CI	**CERTIFICATION YEAR:**	2017
INJECTOR TYPE:	EUI	**CRANKCASE BLOWBY RATE (FT3/HR):**	4,039.5
FUEL INJECTOR:	3920221	**FUEL RATE (RATED RPM) NO LOAD (GAL/HR):**	15.6
UNIT INJECTOR TIMING (IN):	64.34	**PISTON SPD @ RATED ENG SPD (FT/MIN):**	2,539.4
REF EXH STACK DIAMETER (IN):	12		
MAX OPERATING ALTITUDE (FT):	2,461		

INDUSTRY	SUBINDUSTRY	APPLICATION
ELECTRIC POWER	STANDARD	PACKAGED GENSET

General Performance Data

THE INLET MANIFOLD AIR TEMP LISTED IN THE HEADER, AND IN THE GENERAL PERFORMANCE DATA, IS THE AVERAGE INLET MANIFOLD TEMP FRONT TO REAR ON THE ENGINE.

THIS STANDBY RATING IS FOR A STANDBY ONLY ENGINE ARRANGEMENT. RERATING THE ENGINE TO A STANDARD PRIME OR CONTINUOUS RATING IS NOT PERMITTED.

GENSET POWER WITH FAN	PERCENT LOAD	ENGINE POWER	BRAKE MEAN EFF PRES (BMEP)	BRAKE SPEC FUEL CONSUMPTN (BSFC)	ISO BRAKE SPEC FUEL CONSUMPTN (BSFC)	VOL FUEL CONSUMPTN (VFC)	ISO VOL FUEL CONSUMPTN (VFC)	ELEC SPEC FUEL CONSUMPTN (ESFC)	ISO ELEC SPEC FUEL CONSUMPTN (ESFC)
EKW	%	BHP	PSI	LB/BHP-HR	LB/BHP-HR	GAL/HR	GAL/HR	LB/EKW-HR	LB/EKW-HR
2,750.0	100	4,043	373	0.338	0.332	192.9	189.2	0.498	0.488
2,475.0	90	3,655	337	0.334	0.328	172.3	169.0	0.494	0.484
2,337.5	85	3,461	320	0.336	0.330	163.9	160.8	0.497	0.488
2,200.0	80	3,266	302	0.338	0.331	155.6	152.6	0.502	0.492
2,062.5	75	3,072	284	0.340	0.334	147.3	144.5	0.507	0.497
1,925.0	70	2,878	266	0.343	0.336	139.1	136.5	0.513	0.503
1,650.0	60	2,490	230	0.351	0.344	123.2	120.9	0.530	0.520
1,375.0	50	2,102	194	0.363	0.356	107.5	105.4	0.554	0.544
1,100.0	40	1,714	158	0.373	0.366	90.1	88.4	0.581	0.570
825.0	30	1,325	122	0.384	0.377	71.8	70.5	0.618	0.606
687.5	25	1,131	104	0.394	0.387	62.9	61.7	0.649	0.636
550.0	20	937	87	0.409	0.402	54.1	53.1	0.698	0.684
275.0	10	549	51	0.467	0.458	36.1	35.4	0.932	0.914

GENSET POWER WITH FAN	PERCENT LOAD	ENGINE POWER	INLET MFLD PRES	INLET MFLD TEMP	EXH MFLD TEMP	EXH MFLD PRES	ENGINE OUTLET TEMP	COMPRESSOR OUTLET PRES	COMPRESSOR OUTLET TEMP
EKW	%	BHP	IN-HG	DEG F	DEG F	IN-HG	DEG F	IN-HG	DEG F
2,750.0	100	4,043	89.7	120.9	1,247.2	69.7	896.1	96	465.2
2,475.0	90	3,655	79.9	102.0	1,177.6	61.5	857.1	86	428.6
2,337.5	85	3,461	75.8	100.1	1,160.5	58.1	851.5	81	414.7
2,200.0	80	3,266	71.9	98.5	1,145.5	54.8	848.2	77	401.0
2,062.5	75	3,072	67.8	97.4	1,131.8	51.5	846.4	73	387.5
1,925.0	70	2,878	63.6	96.2	1,118.6	48.2	844.6	69	374.0
1,650.0	60	2,490	55.3	93.9	1,093.3	42.0	841.3	60	346.7
1,375.0	50	2,102	46.9	91.1	1,067.7	36.0	838.3	51	316.6
1,100.0	40	1,714	36.6	89.9	1,032.0	28.7	832.3	40	275.0
825.0	30	1,325	25.4	88.2	974.3	21.2	811.3	28	227.7
687.5	25	1,131	20.4	87.3	934.9	17.9	791.9	23	205.6
550.0	20	937	16.0	86.6	884.2	15.0	762.1	18	185.1
275.0	10	549	8.0	84.6	714.9	9.7	636.4	10	144.3

General Performance Data (Continued)

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GENSET POWER WITH FAN	PERCENT LOAD	ENGINE POWER	WET INLET AIR VOL FLOW RATE	ENGINE OUTLET WET EXH GAS VOL FLOW RATE	WET INLET AIR MASS FLOW RATE	WET EXH GAS MASS FLOW RATE	WET EXH VOL FLOW RATE (32 DEG F AND 29.98 IN HG)	DRY EXH VOL FLOW RATE (32 DEG F AND 29.98 IN HG)
EKW	%	BHP	CFM	CFM	LB/HR	LB/HR	FT3/MIN	FT3/MIN
2,750.0	100	4,043	8,332.4	22,051.6	36,608.0	37,975.1	7,997.3	7,319.2
2,475.0	90	3,655	7,853.4	20,133.0	34,488.6	35,710.8	7,517.4	6,906.2
2,337.5	85	3,461	7,604.6	19,374.4	33,337.7	34,497.5	7,265.1	6,682.9
2,200.0	80	3,266	7,346.5	18,607.4	32,131.3	33,232.9	6,995.3	6,441.4
2,062.5	75	3,072	7,067.4	17,824.4	30,845.3	31,888.9	6,710.2	6,183.4
1,925.0	70	2,878	6,782.6	17,045.8	29,542.6	30,529.2	6,425.6	5,925.8
1,650.0	60	2,490	6,233.4	15,564.7	27,073.1	27,946.5	5,882.4	5,438.9
1,375.0	50	2,102	5,678.9	14,065.9	24,551.5	25,313.7	5,328.0	4,936.7
1,100.0	40	1,714	4,977.5	12,157.1	21,327.5	21,966.5	4,626.4	4,295.6
825.0	30	1,325	4,151.9	9,893.9	17,669.9	18,179.6	3,827.4	3,562.6
687.5	25	1,131	3,769.2	8,812.6	16,008.2	16,454.6	3,462.1	3,227.8
550.0	20	937	3,431.9	7,819.9	14,554.5	14,938.7	3,146.9	2,941.1
275.0	10	549	2,823.3	5,742.8	11,937.6	12,194.1	2,576.0	2,431.3

Heat Rejection Data

GENSET POWER WITH FAN	PERCENT LOAD	ENGINE POWER	REJECTION TO JACKET WATER	REJECTION TO ATMOSPHERE	REJECTION TO EXH	EXHAUST RECOVERY TO 350F	FROM OIL COOLER	FROM AFTERCOOLER	WORK ENERGY	LOW HEAT VALUE ENERGY	HIGH HEAT VALUE ENERGY
EKW	%	BHP	BTU/MIN	BTU/MIN	BTU/MIN	BTU/MIN	BTU/MIN	BTU/MIN	BTU/MIN	BTU/MIN	BTU/MIN
2,750.0	100	4,043	50,827	9,124	162,025	87,978	22,342	53,492	171,445	419,468	446,839
2,475.0	90	3,655	46,700	8,321	141,538	76,477	19,956	47,423	154,983	374,677	399,125
2,337.5	85	3,461	44,979	8,138	135,476	72,991	18,982	44,178	146,752	356,391	379,646
2,200.0	80	3,266	43,252	7,985	129,537	69,793	18,018	40,903	138,521	338,278	360,350
2,062.5	75	3,072	41,519	7,846	123,724	66,690	17,061	37,707	130,290	320,314	341,215

Emissions Data

DIESEL

RATED SPEED NOMINAL DATA: 1800 RPM

GENSET POWER WITH FAN		EKW	2,750.0	2,337.5	2,062.5	1,375.0	687.5	275.0
PERCENT LOAD		%	100	85	75	50	25	10
ENGINE POWER		BHP	4,043	3,461	3,072	2,102	1,131	549
TOTAL NOX (AS NO2)		G/HR	20,001	15,536	12,263	6,348	3,506	3,883
TOTAL CO		G/HR	2,776	1,233	1,017	711	1,134	1,123
TOTAL HC		G/HR	305	291	285	264	243	189
TOTAL CO2		KG/HR	1,954	1,657	1,489	1,082	626	359
PART MATTER		G/HR	206.9	122.7	114.2	111.5	119.5	82.4
TOTAL NOX (AS NO2)	(CORR 5% O2)	MG/NM3	2,319.2	2,133.9	1,872.1	1,335.4	1,271.3	2,728.6
TOTAL CO	(CORR 5% O2)	MG/NM3	321.4	169.2	155.3	149.5	421.2	689.5
TOTAL HC	(CORR 5% O2)	MG/NM3	30.7	34.7	37.7	48.2	77.4	97.9
PART MATTER	(CORR 5% O2)	MG/NM3	20.0	14.2	14.8	20.1	37.3	44.3
TOTAL NOX (AS NO2)	(CORR 15% O2)	MG/NM3	860.6	791.8	694.7	495.5	471.7	1,012.5
TOTAL CO	(CORR 15% O2)	MG/NM3	119.3	62.8	57.6	55.5	156.3	255.9
TOTAL HC	(CORR 15% O2)	MG/NM3	11.4	12.9	14.0	17.9	28.7	36.3
PART MATTER	(CORR 15% O2)	MG/NM3	7.4	5.3	5.5	7.5	13.8	16.4
TOTAL NOX (AS NO2)	(CORR 5% O2)	PPM	1,130	1,039	912	650	619	1,329
TOTAL CO	(CORR 5% O2)	PPM	257	135	124	120	337	552
TOTAL HC	(CORR 5% O2)	PPM	57	65	70	90	144	183
TOTAL NOX (AS	(CORR 15% O2)	PPM	419	386	338	241	230	493

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NO2)								
TOTAL CO	(CORR 15% O2)	PPM	95	50	46	44	125	205
TOTAL HC	(CORR 15% O2)	PPM	21	24	26	33	54	68
TOTAL NOX (AS NO2)		G/HP-HR	5.00	4.53	4.03	3.04	3.11	7.09
TOTAL CO		G/HP-HR	0.69	0.36	0.33	0.34	1.01	2.05
TOTAL HC		G/HP-HR	0.08	0.08	0.09	0.13	0.22	0.34
PART MATTER		G/HP-HR	0.05	0.04	0.04	0.05	0.11	0.15
TOTAL NOX (AS NO2)		G/KW-HR	6.80	6.16	5.47	4.13	4.23	9.65
TOTAL CO		G/KW-HR	0.94	0.49	0.45	0.46	1.37	2.79
TOTAL HC		G/KW-HR	0.10	0.12	0.13	0.17	0.29	0.47
PART MATTER		G/KW-HR	0.07	0.05	0.05	0.07	0.14	0.20
TOTAL NOX (AS NO2)		LB/HR	44.09	34.25	27.03	13.99	7.73	8.56
TOTAL CO		LB/HR	6.12	2.72	2.24	1.57	2.50	2.48
TOTAL HC		LB/HR	0.67	0.64	0.63	0.58	0.54	0.42
TOTAL CO2		LB/HR	4,307	3,654	3,282	2,386	1,381	792
PART MATTER		LB/HR	0.46	0.27	0.25	0.25	0.26	0.18
OXYGEN IN EXH		%	9.7	10.4	10.7	11.5	12.4	14.4
DRY SMOKE OPACITY		%	2.7	1.8	1.8	2.1	3.0	2.3
BOSCH SMOKE NUMBER			1.00	0.84	0.83	0.88	1.04	0.90

RATED SPEED POTENTIAL SITE VARIATION: 1800 RPM

GENSET POWER WITH FAN		**EKW**	**2,750.0**	**2,337.5**	**2,062.5**	**1,375.0**	**687.5**	**275.0**
PERCENT LOAD		**%**	**100**	**85**	**75**	**50**	**25**	**10**
ENGINE POWER		**BHP**	**4,043**	**3,461**	**3,072**	**2,102**	**1,131**	**549**
TOTAL NOX (AS NO2)		G/HR	24,002	18,643	14,715	7,618	4,207	4,659
TOTAL CO		G/HR	4,637	2,060	1,698	1,187	1,894	1,876
TOTAL HC		G/HR	405	387	379	352	324	251
PART MATTER		G/HR	289.7	171.8	159.8	156.1	167.3	115.3
TOTAL NOX (AS NO2)	(CORR 5% O2)	MG/NM3	2,783.0	2,560.7	2,246.6	1,602.5	1,525.6	3,274.4
TOTAL CO	(CORR 5% O2)	MG/NM3	536.7	282.6	259.4	249.6	703.4	1,151.5
TOTAL HC	(CORR 5% O2)	MG/NM3	40.8	46.2	50.1	64.1	102.9	130.2
PART MATTER	(CORR 5% O2)	MG/NM3	28.1	19.9	20.7	28.2	52.2	62.0
TOTAL NOX (AS NO2)	(CORR 15% O2)	MG/NM3	1,032.7	950.2	833.6	594.6	566.1	1,215.0
TOTAL CO	(CORR 15% O2)	MG/NM3	199.2	104.9	96.3	92.6	261.0	427.3
TOTAL HC	(CORR 15% O2)	MG/NM3	15.1	17.1	18.6	23.8	38.2	48.3
PART MATTER	(CORR 15% O2)	MG/NM3	10.4	7.4	7.7	10.5	19.4	23.0
TOTAL NOX (AS NO2)	(CORR 5% O2)	PPM	1,356	1,247	1,094	781	743	1,595
TOTAL CO	(CORR 5% O2)	PPM	429	226	208	200	563	921
TOTAL HC	(CORR 5% O2)	PPM	76	86	94	120	192	243
TOTAL NOX (AS NO2)	(CORR 15% O2)	PPM	503	463	406	290	276	592
TOTAL CO	(CORR 15% O2)	PPM	159	84	77	74	209	342
TOTAL HC	(CORR 15% O2)	PPM	28	32	35	44	71	90
TOTAL NOX (AS NO2)		G/HP-HR	6.00	5.44	4.83	3.65	3.73	8.51
TOTAL CO		G/HP-HR	1.16	0.60	0.56	0.57	1.68	3.43
TOTAL HC		G/HP-HR	0.10	0.11	0.12	0.17	0.29	0.46
PART MATTER		G/HP-HR	0.07	0.05	0.05	0.07	0.15	0.21
TOTAL NOX (AS NO2)		G/KW-HR	8.16	7.39	6.57	4.96	5.08	11.57
TOTAL CO		G/KW-HR	1.58	0.82	0.76	0.77	2.28	4.66
TOTAL HC		G/KW-HR	0.14	0.15	0.17	0.23	0.39	0.62
PART MATTER		G/KW-HR	0.10	0.07	0.07	0.10	0.20	0.29
TOTAL NOX (AS NO2)		LB/HR	52.91	41.10	32.44	16.79	9.27	10.27
TOTAL CO		LB/HR	10.22	4.54	3.74	2.62	4.17	4.13
TOTAL HC		LB/HR	0.89	0.85	0.84	0.78	0.71	0.55
PART MATTER		LB/HR	0.64	0.38	0.35	0.34	0.37	0.25

Regulatory Information

Docusign Envelope ID: 9C8EC8DC-4C18-4394-A74F-E7CCFDDA6B5F

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PERFORMANCE DATA[EM5402]

January 30, 2023

EPA EMERGENCY STATIONARY		2011 - ----		
GASEOUS EMISSIONS DATA MEASUREMENTS PROVIDED TO THE EPA ARE CONSISTENT WITH THOSE DESCRIBED IN EPA 40 CFR PART 60 SUBPART IIII AND ISO 8178 FOR MEASURING HC, CO, PM, AND NOX. THE "MAX LIMITS" SHOWN BELOW ARE WEIGHTED CYCLE AVERAGES AND ARE IN COMPLIANCE WITH THE EMERGENCY STATIONARY REGULATIONS.				
Locality	**Agency**	**Regulation**	**Tier/Stage**	**Max Limits - G/BKW - HR**
U.S. (INCL CALIF)	EPA	STATIONARY	EMERGENCY STATIONARY	CO: 3.5 NOx + HC: 6.4 PM: 0.20

Altitude Derate Data

THE TEMPERATURES LISTED IN THE CHART ARE AMBIENT TEMPERATURES. THE FOLLOWING DERATE CHART WAS CALCULATED ASSUMING A 5 DEG C RISE IN AIR TEMPERATURE BETWEEN AMBIENT AND THE TURBOCHARGER INLET.

STANDARD

ALTITUDE CORRECTED POWER CAPABILITY (BHP)

AMBIENT OPERATING TEMP (F)	30	40	50	60	70	80	90	100	110	120	130	140	NORMAL
ALTITUDE (FT)													
0	4,043	4,043	4,043	4,043	4,043	4,043	4,043	4,043	4,043	4,043	4,043	3,991	4,043
1,000	4,043	4,043	4,043	4,043	4,043	4,043	4,043	4,043	4,043	4,043	4,016	3,914	4,043
2,000	4,043	4,043	4,043	4,043	4,043	4,043	4,043	4,043	4,043	3,988	3,874	3,729	4,043
3,000	3,907	3,906	3,905	3,904	3,904	3,901	3,809	3,675	3,532	3,458	3,456	3,453	3,904
4,000	3,786	3,784	3,783	3,781	3,780	3,742	3,629	3,483	3,375	3,346	3,343	3,340	3,781
5,000	3,679	3,678	3,675	3,673	3,671	3,628	3,511	3,386	3,276	3,251	3,249	3,246	3,673
6,000	3,572	3,570	3,568	3,566	3,564	3,515	3,415	3,289	3,164	3,135	3,131	3,128	3,567
7,000	3,451	3,449	3,447	3,445	3,443	3,398	3,295	3,141	2,983	2,960	2,957	2,954	3,446
8,000	3,333	3,331	3,329	3,327	3,325	3,275	3,140	2,951	2,795	2,780	2,777	2,774	3,329
9,000	3,201	3,199	3,197	3,195	3,193	3,115	2,957	2,770	2,630	2,622	2,620	2,617	3,198
10,000	3,051	3,049	3,047	3,045	3,043	2,957	2,798	2,623	2,486	2,483	2,481	2,478	3,048
11,000	2,943	2,941	2,939	2,937	2,935	2,842	2,693	2,514	2,399	2,397	2,395	2,392	2,941
12,000	2,839	2,837	2,835	2,834	2,832	2,741	2,589	2,417	2,347	2,346	2,344	2,342	2,838
13,000	2,748	2,747	2,746	2,744	2,742	2,643	2,486	2,363	2,293	2,292	2,290	2,289	2,748
14,000	2,634	2,634	2,632	2,631	2,630	2,523	2,398	2,289	2,217	2,216	2,216	2,214	2,635
15,000	2,485	2,484	2,483	2,482	2,481	2,408	2,306	2,182	2,091	2,090	2,090	2,089	2,485

Cross Reference

Test Spec	Setting	Engine Arrangement	Engineering Model	Engineering Model Version	Start Effective Serial Number	End Effective Serial Number
5644208	LL2333	5898066	PG266	-	JD700379	
6351348	GG3123	6316330	PG571	XJ	JC700001	

Performance Parameter Reference

Parameters Reference:DM9600-14

PERFORMANCE DEFINITIONS

PERFORMANCE DEFINITIONS DM9600
APPLICATION:
Engine performance tolerance values below are representative of a typical production engine tested in a calibrated dynamometer test cell at SAE J1995 standard reference conditions. Caterpillar maintains ISO9001:2000 certified quality management systems for engine test Facilities to assure accurate calibration of test equipment. Engine test data is corrected in accordance with SAE J1995. Additional reference material SAE J1228, J1349, ISO 8665, 3046-1:2002E, 3046-3:1989, 1585, 2534, 2288, and 9249 may apply in part or are similar to SAE J1995. Special engine rating request (SERR) test data shall be noted.
PERFORMANCE PARAMETER TOLERANCE FACTORS:
Power +/- 3%
Torque +/- 3%
Exhaust stack temperature +/- 8%
Inlet airflow +/- 5%

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Intake manifold pressure-gage +/- 10%
Exhaust flow +/- 6%
Specific fuel consumption +/- 3%
Fuel rate +/- 5%
Specific DEF consumption +/- 3%
DEF rate +/- 5%
Heat rejection +/- 5%
Heat rejection exhaust only +/- 10%
Heat rejection CEM only +/- 10%
Heat Rejection values based on using treated water.
Torque is included for truck and industrial applications, do not use for Gen Set or steady state applications.
On C7 - C18 engines, at speeds of 1100 RPM and under these values are provided for reference only, and may not meet the tolerance listed.
On 3500 and C175 engines, at speeds below Peak Torque these values are provided for reference only, and may not meet the tolerance listed.
These values do not apply to C280/3600. For these models, see the tolerances listed below.
C280/3600 HEAT REJECTION TOLERANCE FACTORS:
Heat rejection +/- 10%
Heat rejection to Atmosphere +/- 50%
Heat rejection to Lube Oil +/- 20%
Heat rejection to Aftercooler +/- 5%
TEST CELL TRANSDUCER TOLERANCE FACTORS:
Torque +/- 0.5%
Speed +/- 0.2%
Fuel flow +/- 1.0%
Temperature +/- 2.0 C degrees
Intake manifold pressure +/- 0.1 kPa
OBSERVED ENGINE PERFORMANCE IS CORRECTED TO SAE J1995 REFERENCE AIR AND FUEL CONDITIONS.
REFERENCE ATMOSPHERIC INLET AIR
FOR 3500 ENGINES AND SMALLER
SAE J1228 AUG2002 for marine engines, and J1995 JAN2014 for other engines, reference atmospheric pressure is 100 KPA (29.61 in hg), and standard temperature is 25deg C (77 deg F) at 30% relative humidity at the stated aftercooler water temp, or inlet manifold temp.
FOR 3600 ENGINES
Engine rating obtained and presented in accordance with ISO 3046/1 and SAE J1995 JANJAN2014 reference atmospheric pressure is 100 KPA (29.61 in hg), and standard temperature is 25deg C (77 deg F) at 30% relative humidity and 150M altitude at the stated aftercooler water temperature.
MEASUREMENT LOCATION FOR INLET AIR TEMPERATURE
Location for air temperature measurement air cleaner inlet at stabilized operating conditions.
REFERENCE EXHAUST STACK DIAMETER
The Reference Exhaust Stack Diameter published with this dataset is only used for the calculation of Smoke Opacity values displayed in this dataset. This value does not necessarily represent the actual stack diameter of the engine due to the variety of exhaust stack adapter options available. Consult the price list, engine order or general dimension drawings for the actual stack diameter size ordered or options available.
REFERENCE FUEL
DIESEL
Reference fuel is #2 distillate diesel with a 35API gravity;
A lower heating value is 42,780 KJ/KG (18,390 BTU/LB) when used at 15 deg C (59 deg F), where the density is 850 G/Liter (7.0936 Lbs/Gal).
GAS
Reference natural gas fuel has a lower heating value of 33.74 KJ/L (905 BTU/CU Ft). Low BTU ratings are based on 18.64 KJ/L (500 BTU/CU FT) lower heating value gas. Propane ratings are based on 87.56 KJ/L (2350 BTU/CU Ft) lower heating value gas.
ENGINE POWER (NET) IS THE CORRECTED FLYWHEEL POWER (GROSS) LESS EXTERNAL AUXILIARY LOAD
Engine corrected gross output includes the power required to drive standard equipment; lube oil, scavenge lube oil, fuel transfer, common rail fuel, separate circuit aftercooler and jacket water pumps. Engine net power available for the external (flywheel) load is calculated by subtracting the sum of auxiliary load from the corrected gross flywheel out put power. Typical auxiliary loads are radiator cooling fans, hydraulic pumps, air compressors and battery charging alternators. For Tier 4 ratings additional Parasitic losses would also include Intake, and Exhaust Restrictions.
ALTITUDE CAPABILITY
Altitude capability is the maximum altitude above sea level at standard temperature and standard pressure at which the engine could develop full rated output power on the current performance data set.
Standard temperature values versus altitude could be seen on TM2001.
When viewing the altitude capability chart the ambient temperature

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is the inlet air temp at the compressor inlet.
Engines with ADEM MEUI and HEUI fuel systems operating at conditions above the defined altitude capability derate for atmospheric pressure and temperature conditions outside the values defined, see TM2001.
Mechanical governor controlled unit injector engines require a setting change for operation at conditions above the altitude defined on the engine performance sheet. See your Caterpillar technical representative for non standard ratings.
REGULATIONS AND PRODUCT COMPLIANCE
TMI Emissions information is presented at 'nominal' and 'Potential Site Variation' values for standard ratings. No tolerances are applied to the emissions data. These values are subject to change at any time. The controlling federal and local emission requirements need to be verified by your Caterpillar technical representative.
Customer's may have special emission site requirements that need to be verified by the Caterpillar Product Group engineer.
EMISSION CYCLE LIMITS:
Cycle emissions Max Limits apply to cycle-weighted averages only. Emissions at individual load points may exceed the cycle-weighted limit.
WET & DRY EXHAUST/EMISSIONS DESCRIPTION:
Wet - Total exhaust flow or concentration of total exhaust flow
Dry - Total exhaust flow minus water vapor or concentration of exhaust flow with water vapor excluded
EMISSIONS DEFINITIONS:
Emissions : DM1176
EMISSION CYCLE DEFINITIONS
1. For constant-speed marine engines for ship main propulsion, including,diesel-electric drive, test cycle E2 shall be applied, for controllable-pitch propeller sets
test cycle E2 shall be applied.
2. For propeller-law-operated main and propeller-law-operated auxiliary engines the test cycle E3 shall be applied.
3. For constant-speed auxiliary engines test cycle D2 shall be applied.
4. For variable-speed, variable-load auxiliary engines, not included above, test cycle C1 shall be applied.
HEAT REJECTION DEFINITIONS:
Diesel Circuit Type and HHV Balance : DM9500
HIGH DISPLACEMENT (HD) DEFINITIONS:
3500: EM1500
RATING DEFINITIONS:
Agriculture : TM6008
Fire Pump : TM6009
Generator Set : TM6035
Generator (Gas) : TM6041
Industrial Diesel : TM6010
Industrial (Gas) : TM6040
Irrigation : TM5749
Locomotive : TM6037
Marine Auxiliary : TM6036
Marine Prop (Except 3600) : TM5747
Marine Prop (3600 only) : TM5748
MSHA : TM6042
Oil Field (Petroleum) : TM6011
Off-Highway Truck : TM6039
On-Highway Truck : TM6038
SOUND DEFINITIONS:
Sound Power : DM8702
Sound Pressure : TM7080
Date Released : 10/27/21

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3/18/2024

Romeo Macatula
Carter Machinery Co.
11441 Robertson Drive
Manassas, VA 20109

Phone: 571-539-6662
E-Mail: Romeo_Macatula@CarterMachinery.com

Submittal Revision:
Project Reference:
MIRATECH Kit Number: SP-KIT-M3-SW550-TLI-23120476

MIRATECH Scope of Supply		
Model Number	**Description**	**Quantity Per Engine**
SP-KIT-M3-SW550-TLI-23120476	**SCR/DOC/DPF Combo Housing, Tank, HT & Dosing System Kit**	
SP-M3-KIT-23080079	**SCR/DOC/DPF Combination Housing & Dosing System Kit**	1
M3Z-72-63-J-23060132	**DOC/SCR/DPF Housing**	-
M3Z-72-63-J-23060132-HSG	DOC/SCR/DPF Housing	1
STS-M3Z-63-23060132	SCR Tray Set	2
DTS-M3-72	DPF Tray Set	1
SCRC-044-075-450	SCR Catalyst	126
MECR-OX-SB2069-2400-1450-291	Oxidation Catalyst	4
LTR2-DPF-Filter-Block	DPF Block	72
ACIS-3	**SCR Control System**	-
A3C-60-HMI	SCR Controller	1
SP-CA75-ULC-19030058	Air Compressor	1
SP-VPNU75-UL-23080035	Reactant Pump	1
FILTER115	Reactant Filter	1
SEN60-U-WT	Dosing Box	1
DEN75-700-U	Injector	1
TT-14-FLEX60-32-1112	Temperature Sensor	2
NP-18	Bypass Probe	2
PT-0-40	Differential Pressure Sensor	1
NOX-24V	NOx Sensor	2
WH-NOX-24V-50-SL	Wiring Harness	2
FACINS-M3Z-72-63-23060132	**3" Thick Mineral Wool Insulation with Aluminum Sheathing**	1
Commissioning & Startup	**Commissioning & Startup**	Per Project
SW550.ht.ins-TLI-KIT-ADDER		
SW550.ht.ins	**Single Wall Reactant Tank, Heat Traced & Insulated**	1
TLI	**Reactant Tank Level Indicator**	-
US06	Level Transmitter	1
LI55	Level Controller	1
LM92	Level Controller Enclosure	1

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SYSTEM OPERATION

A MIRATECH SCR System consists of numerous pieces of equipment, that work with each other to achieve emissions reduction. A typical SCR system will consist of the following:

- Selective Catalytic Reduction (SCR) Housing
- Diesel Oxidation Catalyst (DOC) / Diesel Particulate Filter (DPF) Housing **or**,
- Oxidation Catalyst Housing
- Mixing Section
- Dosing Box
- Air Compressor
- Reactant Booster Pump
- SCR Controller
- Temperature Sensor

Note: Please reference the MIRATECH scope of supply located with the Technical Submittal in Appendix A.

Selective Catalytic Reduction (SCR)

SCR is applied to reduce NOx emissions when the waste gas stream contains more than 2% 0_2. Oxides of nitrogen (NOx) and ammonia react in the presence of a selective catalyst to form water vapor and nitrogen gas:

$$4NO + 4NH_3 + O_2 \text{ ---------- } 6\ H_2O + 4\ N_2$$

$$2NO_2 + 2NH_3 \text{ ---------- } 2N_2 + 3H_2O + 1/2\ O_2$$

Operating Temperature: 572 - 977° F (300 - 525° C) Continuous 1,022° F Maximum (</= 4 hours)

Catalyst Material: Metallic-Oxide catalyst, on the base of Titanium oxide, Tungsten oxide, and Vanadium pentoxide. Ceramic honeycombs are extruded with these materials.

Catalytic Function:

1. Urea ($CO(NH_2)_2$) or Ammonia (NH_3) is injected into the waste gas stream via the injector mounted on the mixing section in front of the SCR housing. The temperature control system will only allow reactant (urea or ammonia) injection when exhaust gases are in the proper temperature range. The rate of ammonia or urea injection is based on feedback from continuous NOx or engine load measurements.
2. The oxides of nitrogen, NO and NO_2, are transformed by the SCR process into Nitrogen N_2 and water vapor by means of a reducing agent (urea or ammonia). This process is used with high oxygen-content exhaust gases. Extremely low NOx concentrations can be attained. The

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urea solution is injected into the stream of exhaust gas using compressed air by means of a specially developed dual medium nozzle. Open cross flow static mixers guarantee optimum blending with the exhaust gases.

3. NH_3 is adsorbed into the micropores of the catalyst and reacts with NOx.
4. The reaction products, N_2 and H_2O vapor, desorb from the catalyst surface.

DOC/DPF and Oxidation Catalyst

A DOC/DPF housing for diesel fuel applications is located upstream of the reactant injector and SCR housing. The DPF blocks are made of a porous ceramic substrate which captures the particulate matter (PM) with a filtration efficiency of 85% or better. Once the PM is captured, it can be catalytically oxidized with the support of NO_2 for the oxidation process. The DOC is coated with precious metals to promote specific oxidation reactions to convert:

- CO to CO_2
- Unburned Hydrocarbons (HC) to CO_2 and H_2O (Water)
- Some NO will be converted to NO_2, to support the regeneration process in the DPF blocks.

For gaseous fuel applications, the oxidation catalyst can be located upstream of the SCR in its own housing. In some applications the oxidation catalyst can be placed downstream of the SCR catalyst within the SCR housing. Like the DOC, the oxidation catalyst addresses the HC and CO reductions.

SCR Controller

The MIRATECH SCR Controller is used to control the amount of reactant injected in the SCR System and can operate with liquid urea or liquid ammonia as the reactant. The controller meters the flow of reactant to maintain system set points based on a load curve programmed during commissioning. It also controls various pumps, compressors, and metering agents to control the dosing rate of reactant.

The SCR control system requires the following conditions to be met before reactant injection will take place:

- Engine Running
  - 24V signal
- Engine load signal
  - 4-20 mA signal
- Minimum injection temperature reached
  - 300C / 572F
- System in automatic mode
- No critical faults

When the engine run signal is received, the SCR controller will signal the air compressor to turn on keeping the injector cool from the hot exhaust gases. Once the above permissives have been met, the

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system will begin reactant injection based on the load curve programmed during commissioning. When the permissives are no longer met, the system will cease injection and go into purge mode which serves two purposes 1) remove urea from the urea tubing between the dosing box and injector 2) injector cooling. If the permissives are satisfied, injection will resume. Otherwise, the system will continue to purge the injector as long as the run signal is active. When the engine shuts down (run signal removed), the system will continue to purge for approximately ten minutes, after which the compressor is shut off and the systems enters a standby state.

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IMPORTANT SCR OPERATING TEMPERATURES

Like any catalyst system, the SCR process is dependent on temperature to function properly. There are two key temperatures to remember: 572°F (300°C) and 977°F (525°C). The first key temperature is for urea (also known as DEF - Diesel Exhaust Fluid) injection to initiate and the second is the maximum continuous operating temperature for SCR catalyst.

Figure 1 below shows a MIRATECH Mixing Section. The Mixing Section is designed to introduce DEF to the exhaust gas stream and to facilitate hydrolysis (the process of breaking urea down to ammonia, which reacts with NOx at the catalyst). Urea hydrolysis is most active at exhaust temperatures above 572°F (300°C). The SCR control system monitors the exhaust temperature immediately downstream of the SCR catalyst and starts DEF injection when the temperature reaches 572°F (300°C).

Operating below 572°F (300°C) will not harm the SCR system, however since DEF injection will not turn on, NOx will not be reduced. Engines should be operated according to the engine manufacturers recommendations regarding prolonged low or no-load operation. If an engine is "wet stacking" there is a risk that unburned (wet) lube oil and/or fuel can accumulate in the SCR catalyst which could lead to the catalyst being poisoned. A list of Catalyst poisons is included in the manual but include zinc, phosphorous, and other metals that may be additives in the lube oil. Pure ULSD fuel based hydrocarbons are not 'poisons' and should have little to no effect on the SCR performance once they are burned off during normal operation.

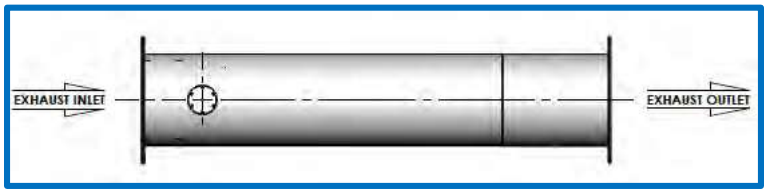


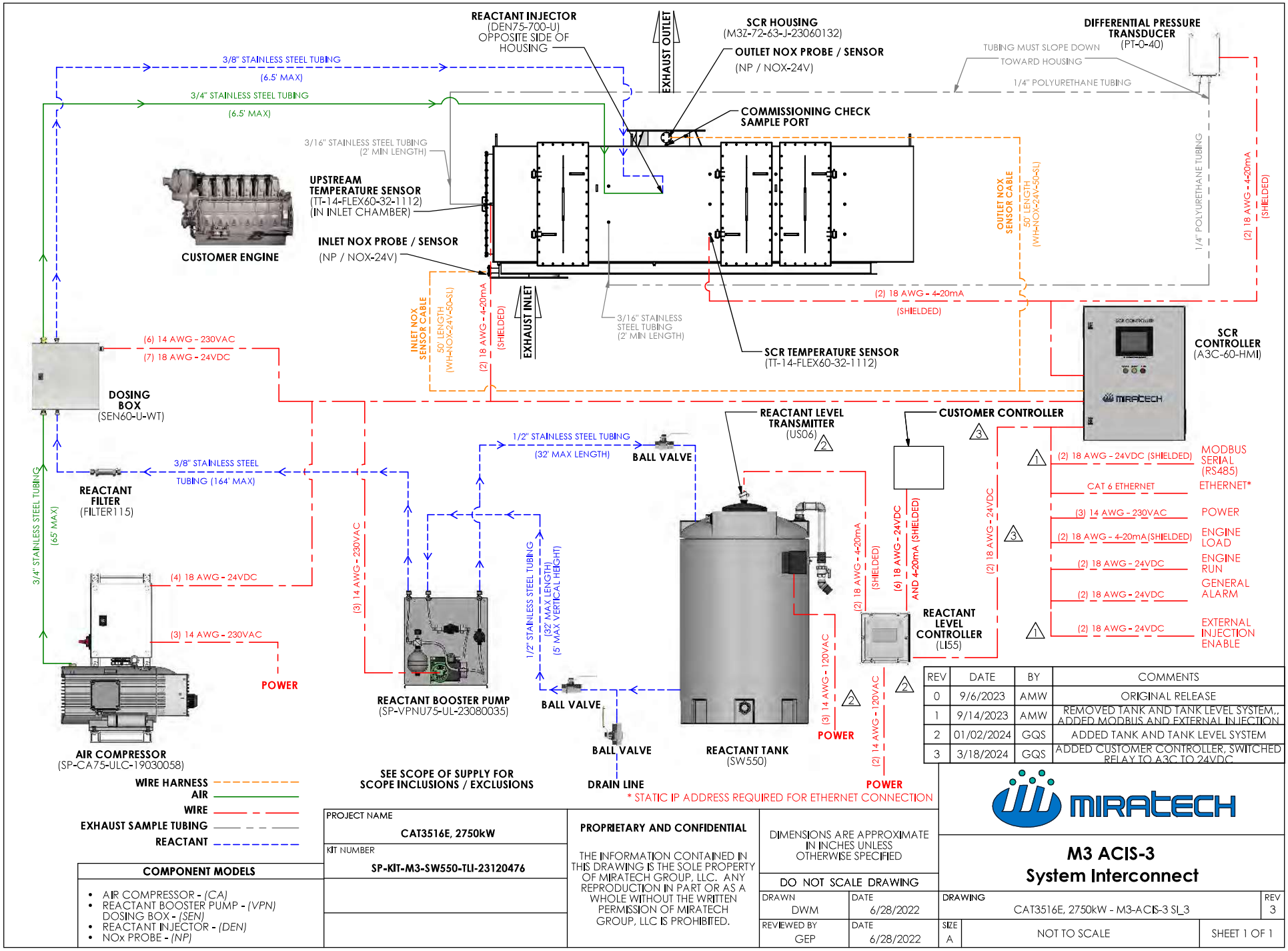
Figure 1: SCR Mixing Section

The second key temperature is the maximum continuous operating temperature of the SCR catalyst. A typical SCR catalyst block is shown in Figure 2. The extruded ceramic base material has varying amounts of Vanadium and Tungsten distributed throughout. The maximum continuous operating temperature is 977°F (525°C). Above this temperature, some of the ammonia created during urea hydrolysis will oxidize into NOx, meaning one must over-inject DEF to compensate. Prolonged operation above 977°F (525°C) also shortens the catalyst life. The catalyst can withstand short term operation up to 1022°F (550°C), so it can tolerate upset conditions such as an engine misfire or overload. The SCR control system provides temperature alarms to alert the operator of high temperature conditions.



Figure 2: SCR Catalyst Block

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REV	DATE	BY	COMMENTS
0	9/6/2023	AMW	ORIGINAL RELEASE
1	9/14/2023	AMW	REMOVED TANK AND TANK LEVEL SYSTEM., ADDED MODBUS AND EXTERNAL INJECTION
2	01/02/2024	GQS	ADDED TANK AND TANK LEVEL SYSTEM
3	3/18/2024	GQS	ADDED CUSTOMER CONTROLLER, SWITCHED RELAY TO A3C TO 24VDC

COMPONENT MODELS

- AIR COMPRESSOR - *(CA)*
- REACTANT BOOSTER PUMP - *(VPN)*
- DOSING BOX - *(SEN)*
- REACTANT INJECTOR - *(DEN)*
- NOx PROBE - *(NP)*

PROJECT NAME: CAT3516E, 2750kW

KIT NUMBER: SP-KIT-M3-SW550-TLI-23120476

PROPRIETARY AND CONFIDENTIAL

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DO NOT SCALE DRAWING

DRAWN	DATE	REVIEWED BY	DATE
DWM	6/28/2022	GEP	6/28/2022

MIRATECH

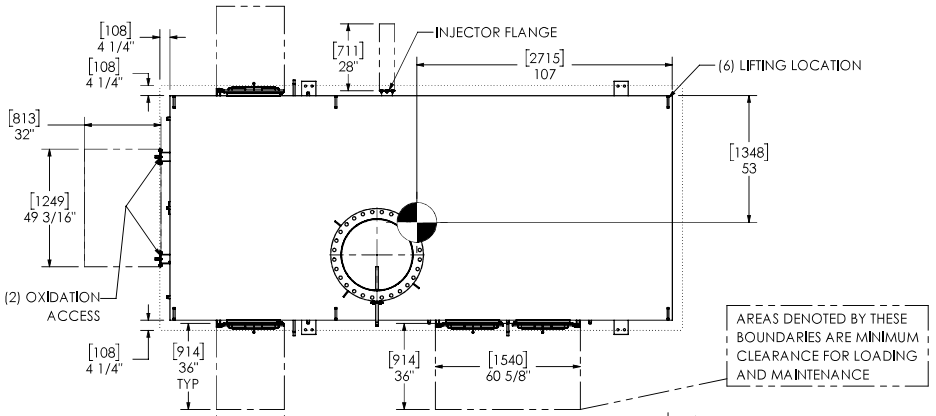
M3 ACIS-3 System Interconnect

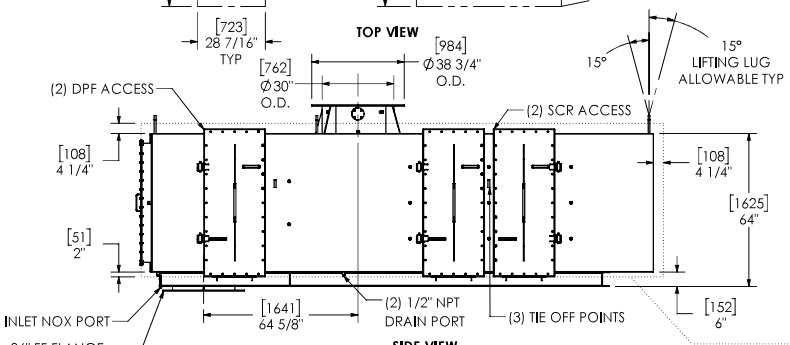
DRAWING	REV
CAT3516E, 2750kW - M3-ACIS-3 SI_3	3

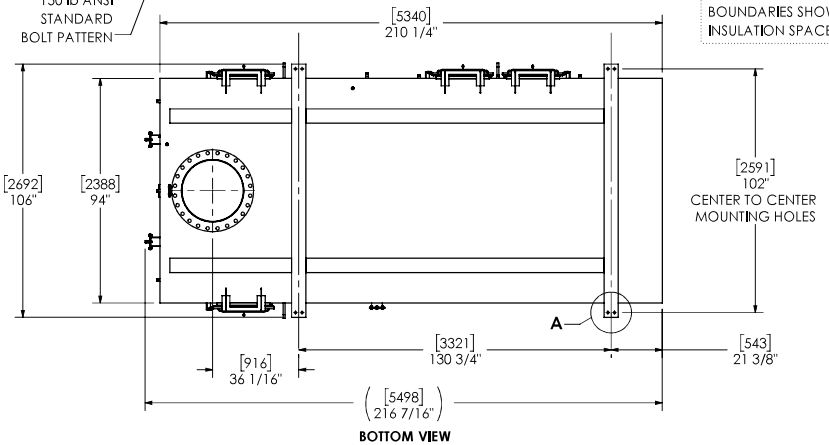
SIZE		
A	NOT TO SCALE	SHEET 1 OF 1

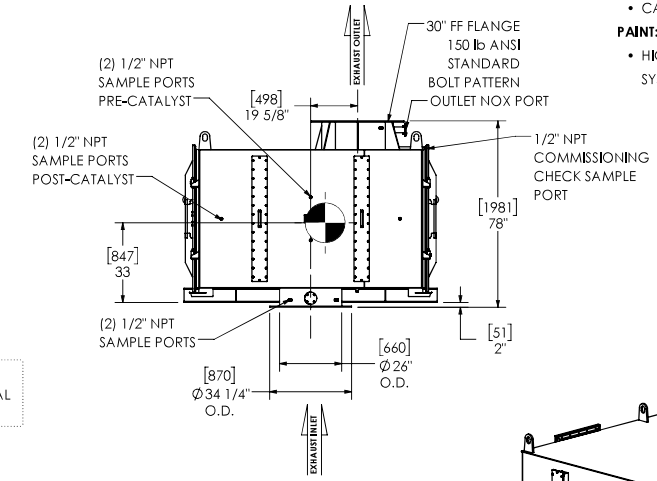
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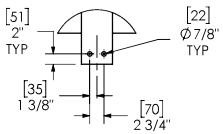
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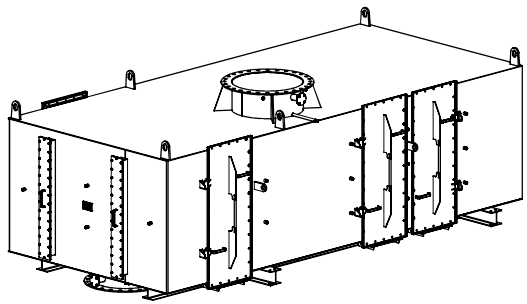








DETAIL A
SCALE 1 : 24



WEIGHTS (APPROXIMATE)	
EMPTY HOUSING	8600 lb
ONE (1) FULL SCR CATALYST LAYER	1102 lb
TWO (2) FULL SCR CATALYST LAYERS	2204 lb
ONE (1) FULL DPF LAYER	1260 lb
FOUR (4) OXIDATION ELEMENTS	140 lb
INSULATION AND SHEATHING	1841 lb
HOUSING HAS CAPACITY FOR TWO (2) FULL SCR CATALYST LAYERS	

NOTES:

- DO NOT USE EQUIPMENT TO SUPPORT OTHER PARTS OF THE EXHAUST SYSTEM WITHOUT PROPER REINFORCEMENT
- CUSTOMER MOUNTING STRUCTURE TO BE SLOTTED TO ALLOW FOR METAL EXPANSION
- LIFTING HOUSING REQUIRES USE OF ALL (6) LIFTING LOCATIONS

MATERIAL CONSTRUCTION:

- CARBON STEEL

PAINT:

- HIGH TEMPERATURE DARK GRAY (MIRATECH COATING SYSTEM 2)

PROJECT NAME: CAT3516E, 2750kW	PROPRIETARY AND CONFIDENTIAL	DIMENSIONS ARE APPROXIMATE IN INCHES UNLESS OTHERWISE SPECIFIED	MIRATECH
KIT NUMBER: SP-KIT-M3-SW550-TLI-23120476	THE INFORMATION CONTAINED IN THIS DRAWING IS THE SOLE PROPERTY OF MIRATECH GROUP, LLC. ANY REPRODUCTION IN PART OR AS A WHOLE WITHOUT THE WRITTEN PERMISSION OF MIRATECH GROUP, LLC IS PROHIBITED.	DIMENSIONAL TOLERANCES UNLESS OTHERWISE SPECIFIED: ANGLES ±0° MACH ±0.5° BEND ±1° / INCHES ±1/8 / MILLIMETERS ±3	M3Z-72-63-J-23060132 Submittal Drawing
		DO NOT SCALE DRAWING	
		DRAWN: JDS — DATE: 07/05/2023	DRAWING: M3Z-72-63-J-23060132 SD — REV: 0
		REVIEWED BY: MSC — DATE: 07/05/2023	SIZE: B — SCALE 1:52 — SHEET 1 OF 1

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MIRATECH

Application & Performance Warranty Data

Project Information

Site Location:	Various
Project Name:	CAT3516E, 2750kW
Application:	Standby Power
Number Of Engines:	Various
Operating Hours per Year:	100

Engine Specifications

Engine Manufacturer:	Caterpillar
Model Number:	3516E
Rated Speed:	1800 RPM
Type of Fuel:	Ultra-Low Sulfur Diesel (ULSD)
Type of Lube Oil:	1 wt% sulfated ash or less
Lube Oil Consumption:	0.1 % Fuel Consumption
Number of Exhaust Manifolds:	1

Engine Cycle Data

Load	Speed	Power	Exhaust Flow	Exhaust Temp.	Fuel Cons.	NO_x	CO	NMHC	PM_{10}	O_2	H_2O
%		*bhp*	*acfm (cfm)*	*° F*	*gal/hr*	*g/bhp-hr*	*g/bhp-hr*	*g/bhp-hr*	*g/bhp-hr*	*%*	*%*
100	Rated	4,043	22,051	897	192.9	6	1.16	0.1	0.07	9.4	10

Emission Data (100% Load)

Emission	Raw Engine Emissions						Target Outlet Emissions						Calculated Reduction
	g/bhp-hr	*tons/yr*	*ppmvd @ 15% O_2*	*ppmvd*	*g/kW-hr*	*lb/MW-hr*	*g/bhp-hr*	*tons/yr*	*ppmvd @ 15% O_2*	*ppmvd*	*g/kW-hr*	*lb/MW-hr*	
NO_x*	6	2.67	496	966	8.046	17.74	0.5	0.22	41	81	0.671	1.48	91.7%
CO	1.16	0.52	157	307	1.556	3.43	0.35	0.16	47	92	0.467	1.03	70%
NMHC**	0.1	0.04	24	46	0.134	0.3	0.05	0.02	12	23	0.067	0.15	50%
PM_{10}	0.07	0.03	22	43	0.094	0.21	0.02	0.01	7	14	0.03	0.07	68.6%

* MW referenced as NO_2

** MW referenced as CH_4. Propane in the exhaust shall not exceed 15% by volume of the NMHC compounds in the exhaust, excluding aldehydes. The 15% (vol.) shall be established on a wet basis, reported on a methane molecular weight basis. The measurement of exhaust NMHC composition shall be based upon EPA method 320 (FTIR), and shall exclude formaldehyde.

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System Specifications (SP-KIT-M3-SW550-TLI-23120476)

DOC/SCR/DPF/ACIS-3 Kit System Specifications (M3Z-72-63-J-23060132-R4, ACIS-3, Commissioning & Startup, FACINS-M3Z-72-63-23060132, SW550.ht.ins, TLI)

SCR Catalyst Space Velocity:	11,234 lb/hr
Sound Attenuation:	25-30 dBA insertion loss
Reactant:	Urea
Percent Concentration:	32.5%
Design Exhaust Flow Rate:	22,051 acfm (cfm)
Design Exhaust Temperature[1]:	897° F
Urea Feed Temperature : Minimum	572° F
Regeneration Temperature[2]: cDPF	500° F
Catalyst Volume:	45 ft³
System Dosing Capacity:	60 L/hr
System Pressure Loss:	17.0 inH_2O (Clean)
Maximum Pressure Loss:	40.2 inH2O
Total Catalyst Volume:	45 ft³
Estimated Reactant Consumption:	13.5 gal/hr (51 L/hr) / Per Engine

Special Notes & Conditions

1. For housings and exhaust components that are insulated, internally or externally, please refer to the Limited Warranty section of the negotiated Terms and Conditions document to prevent voiding MIRATECH product warranty. - Carbon steel is suitable for temperatures up to 900° F / 482° C continuously, when covered with external insulation or a heat shield. For continuous operation above 900° F / 482° C, where the equipment is externally insulated or has a heat shield, stainless steel should be used.

2. Diesel Particulate Filters depend on exhaust temperature to keep soot regenerated and the filter back pressure within acceptable levels. If the engine will be operated consistently at low loads/low exhaust temperatures, the customer should make provisions to add load via facility operations or a load bank. Refer to the included *Guidelines for Successful Operation of LTR™ DPF*.

- A packed silencer installed upstream of the MIRATECH catalyst system will void MIRATECH's limited warranty.
- Any sound attenuation listed is based on housing with catalyst elements installed.
- MIRATECH Corporation warrants that the emissions reductions requested for this inquiry will be achieved at the design and test load point as outlined in the proposal. Tier 4 is an engine certificate designation, not an actual tons/yr or g/bhp-hr measurement. MIRATECH will utilize the engine manufacturer's emission data at 100% load to provide our warranty. This is the maximum volume potential point for pollutants to be emitted. Permitting is normally done on a mass flow or tons per year basis, therefore the system will be sized accordingly. The MIRATECH design is to achieve the blended Tier 4 emission targets from the D2 test cycle, measured at 100% engine load conditions.
- Any emission reductions listed are based on housing with catalyst elements installed.

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Safety Power ecoCUBE® SCR Emission Control System

Prepared by:

Safety Power Inc.
Jacob Rozenblit
Applications Engineering Manager
Office (514) 927-2898
Fax 416.477.2709
www.safetypowerinc.com

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SUMMARY

Overview	Item Description	Price (USD)
ecoCUBE® System	System Style	**SCR + catalyzed DPF**
	ecoCUBE® Part #	(9550-H3C29)
	Factory installed sensors & reactor wiring	Included
	4" insulation & metal cladding	Included
	Commissioning & training (allocation = 2 days/system, excludes travel & living)	Included
	CP100 control and dosing panel	Included
System Accessories	Breather Valve, Urea Tank	
	Dual Tankless Compact Oil-less Air Compressor	
	Level Sensor, Urea Tank	
	270 USG (1023 L) single wall urea tank w/ fittings	

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*270 USG urea tank added per Carter CAT request. Please note that this tank does not comply with AWS spec. The spec asked for a custom subbase tank with 36hr capacity. This is a standard HDPE tank which will provide about 26hours at full engine load operation.

Safety Power is a global innovator and a leading supplier for large stationary engines. Safety Power has the **technical resources** to provide support during installation and throughout the life of the equipment.

Key features and benefits of the proposed system include:

- Safety Power's ecoCUBE® system will be designed with its proprietary **Closed Loop control** system to provide NOx emissions reduction performance throughout varying engine loads while minimizing ammonia slip
- SCR reactor housing, mixing duct are fabricated from durable **409 stainless steel** and the static mixers, turning vanes and injection lance from **304 stainless steel.**
- The proprietary catalyst used in the SCR reactor is a homogeneous design providing superior emissions reduction in a compact configuration with superior spalling and degradation resistance over the life of the catalyst.
- The SCR control and dosing system is designed with an industrial grade **urea injection pump system** for maximum reliability and precise control
- Passive regeneration of the DPF is promoted without the addition of external heat source.
- All ecoCUBE® emissions control systems are capable of withstanding operating pressures up to 40" W.C., further design pressure can be achieved if required.
- The system supplied comes equipped with **remote monitoring & diagnostics** capability
- The system comes supplied with all necessary exhaust temperature, differential pressure and NOx sensor field instruments for monitoring and control

The ecoCUBE® system proposed by Safety Power has been tested & verified by independent consultants and regulatory authorities to meet some of the toughest global emissions standards.

Included within this proposal is the recommended servicing of the ecoCUBE® units.

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DESIGN PARAMETERS

The design of the Safety Power emissions reduction system is based on the following conditions.
Note: NOx is calculated as NO_2.

Table 1 – Engine Data

Engine Type:	CAT 3516E
Application	Stand-by
Engine Power	2,750 ekW
Exhaust Temperature	897 °F
Design Exhaust Flow Rate	21,724 (CFM)
Fuel Type	Diesel

Table 2 – Emissions Data at Full Engine Load

Engine Option	Emissions	Not to Exceed Catalyst Inlet (g/bhp-h)	Emissions Requirement (g/bhp-h)	Catalyst Outlet (g/bhp-hr)	Catalyst Outlet (g/kwh)	Catalyst Outlet (lbs/MW-h)	Catalyst Outlet (ppmvd at @15%O2)	Catalyst Outlet (% reduction)
CAT 3516E (2,750 ekW)	NOx	6.0	0.50	0.50	0.67	1.62	40	91.7
	CO *	1.16	2.60	0.23	0.31	0.75	31	80.0
	VOC *	0.10	0.14	0.06	0.08	0.18	5	60.0
	PM	0.07	0.022	0.022	0.03	0.07	***	75.6

* Reductions assume an exhaust temp of 662 degF (350 degC) or more.
*** Particulate matter is a mass quantity and must be determined and reported gravimetrically. As per EPA Method 5 measurement method, PM emissions should not be reported in ppmvd. We would always advise that PM measurements to be taken with front half as this is the most appropriate for this application.
*Please note that any % reductions used for air permitting purposes should be based off of NTE values.

Notes: (1) The EPA does not treat methane and ethane as VOC's. Safety Power can achieve a stated reduction of VOC's based on the EPA definition assuming that the VOC's manifest themselves as propene. (2) all emissions reductions are based on an average at steady state using SCAQMD method 100.1 for NOx and SCAQMD/EPA methods 25.1/25.3 for CO and VOC's or mutually agreed test method approved in writing. (3) if NMHC/VOC data isn't provided 0.6 g/hp-hr is to be assumed (unless otherwise stated).

Table 3 – SCR System Data

Engine Option	CAT 3516E (2,750 ekW)
Max. Ammonia Slip @ 15% O2	8 ppm
Urea Consumption - 32.5% solution (+/- 15%)	10.3 USG/hr
Nominal System Pressure Loss	17.5" WC*
Maximum System Pressure Loss	40.1" WC
System Inlet/Outlet ANSI Flange Inches	26/30

*Carter CAT systems starting 2025 will have 17.5''WC pressure drop. Previous systems were 19.5''WC

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ECOCUBE® SYSTEM SCOPE OF SUPPLIES AND SERVICES

Table 4 – Components Supplied for Each System

ecoCUBE System Components Description (For Each Engine)	CAT 3516E
1. Reactor Assembly (Part Number)	**5 Series (9550-H3C29)**
1.1 ecoCUBE system configuration	SCR + DPF
1.2 ecoCUBE SCR Reactor assembly 409 s/s c/w temperature, pressure and NOx sensors	1
1.3 Reactor assembly weight with catalyst	12,450 lbs
1.4 SCR Catalyst - layers of catalyst material (each system)	3
1.5 DPF Filter Modules	29
2. Control and Dosing Assembly	
2.1 Control Panel – with embedded control, on-off switch, on-off status indicator light, and power distribution. Ability for remote monitoring and troubleshooting if Internet connection provided. Dosing System – with automatic flow rate adjustment, system purge valve, air regulator, air pressure switch, check valves, overpressure regulator and injection valves, injection pumps.	Included
3. Insulation of each ecoCUBE with 4 inches MW insulation and metal cladding. Note: skin surface temperature does not exceed 70 deg C except for exhaust and access door flanges.	Included
4. Duration of warranty (warranty is limited to parts only):	24 months
5. Commissioning (excludes travel expenses)	Included
6. Operation & Maintenance Manuals (digital version)	Included

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EXCLUSIONS & EXCEPTIONS

1. Installation of SPI supplied equipment is by OTHERS.
2. Transition ductwork from ecoCUBE® to stack.
3. Connection from engine exhaust to ecoCUBE® inlet.
4. Gaskets used upstream of the ecoCUBE® shall not contain silica as this can harm the catalyst and will void the catalyst warranty.
5. Structural supports or anchors
6. Power supplies for SCR control panel, air compressor or urea transfer pump skid.
7. Engine on/off signal – Note: required for automatic starting of ecoCUBE® system.
8. Permits and/or certification testing, etc.
9. Emissions performance will be met provided that the actual engine emissions parameters correspond to the engine data sheet and that the fuel composition information provided corresponds to conditions at the site.
10. NOx reduction is achieved once SCR catalyst temperature exceeds 572 deg F
11. Certain regulators may require the use of specific components that have been pre-certified to their standards. Unless stated otherwise in this proposal, Safety Power's guarantee is based on emissions performance of its entire system; there is no guarantee that the system contains specific internal components required by a local regulator.
12. Urea piping from urea tank(s) to the dosing panel. Urea and air piping between dosing panel and injection lances.
13. Customer to ensure that any gaskets upstream of ecoCUBE® are rated for the appropriate engine exhaust temp. Decomposition of gasket material may poison catalyst and will void catalyst warranties offered by Safety Power.
14. Air compressor connections (electrical and tubing). Note: a clean dry supply of air (as per ISO 8573.1 Class 1.4.2) 10CFM @ 80psi per system is required.

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COMMENTS, CLARIFICATIONS & CUSTOMER REQUIREMENTS

1. This proposal is based upon full load engine data.
2. The Urea used shall be 32.5% concentration (ISO 22241 standard). The dosing panel, tanks and lines with urea must be protected from freezing e.g. by heat tracing and insulating, locating the panel, tank & lines in an area that is maintained at a temperature above the freezing temperature. Set heat trace to 5°C (41°F). Optionally use Unitherm part No. 2266-44B49-141012.
3. Systems with diesel particulate filters (DPF) must be operated with ultra-low sulfur diesel* only. In order to properly regenerate the DPF canisters the temperature must be above 280°C (536°F) for 30% of the engine operating time and greater than 40% engine load.
4. **Please note that a load bank would be required to periodically regenerate the DPF filters. - Under ideal conditions the system can accommodate up to 24 cold starts or more. That said, regeneration may be required in as little as 18 cold starts depending on operating conditions.** Depending on the number of cold starts and other items related to use of the system, Diesel Particulate Filters may require regular cleaning. The SPI system incorporates a virtual soot sensor which indicates the number of expected Run Hours Available (RHA) so that the operator is aware of when the next cleaning cycle is required. It is important that the operator monitor RHA to avoid high engine back pressure. **Safety Power recommends that operators monitor RHA & dP across the system and regenerate the system based on observed conditions. The minimum regeneration temperature is 260 degC.**
5. Unless expressly included in SPI's scope of supply the responsibility for allowing for thermal expansion of the products supplied by SPI is "by others".
6. Under no circumstances should the ecoCUBE® be placed downstream of a silencer with absorptive acoustical material.
7. SCR commissioning requires a customer supplied load bank to operate the generator at various load points and establish the controls load map. The customer should allow 4 hours per machine for the SCR load map to be established, 4 hours of testing and verifying SCR system operation, and where required, 1 hour for a third party witnessing of the SCR operation and performance.
8. A 4-20mA signal proportional to engine load must be provided and connected into ecoCUBE® control panel. Customer must provide the current transducer and current transformer for 1-phase.
9. An ethernet connection with access to the internet through Port 80 is requried for each ecoCUBE® control panel; this connection is used for remote montioring, product support and client web browser access.
10. Siloxanes can't be present in the exhaust stream as they will poison the catalyst. Please note that the presence of Siloxanes in the exhaust will void Safety Power's warranty.

* Use of Renewable Diesel, including HVO also approved, see email confirmation from Safety Power (pages 63 - 104)

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Technical Guarantee

The system and catalytic material shall be warranted in accordance with the standard Performance & System Warranty (attached).

Safety Power warrants the quality and suitability of the materials, design and construction of the supplies and services and their qualification for the application. Provided the design data is adhered to, Safety Power guarantees the output values as shown in Table 2 and the Performance & System Warranty.

The maximum allowed temperature entering the Catalyst is 1022° F (for NOx reduction) for up to 4 hours. Operations at Catalyst temperatures above 1022° F may lead to degraded Catalyst activity over 4 hours. System performance can't be guaranteed if large variations exist in the full load NOx output of the engine (> +/- 20%) while the generator is operating at a steady state electrical output.

If the engine runs with an exhaust temperature below 410°F (for ULSD or Pipe Line Natural Gas), the SCR control system will stop the injection of urea. This will prevent the formation of ammonium (bi) sulfate on the SCR catalyst surface. Full load NOx reduction will not be achieved at exhaust temperatures less than 572°F.

The SCR Catalyst is warranted from defects for a period of 8,000 hours (2-years pro-rata), based in accordance with the operation manual. If the proposed system also includes an Oxidation Catalyst or Oxidation Catalyst Modules, this catalyst is warranted for 8,000 hours (2-years pro-rata), based in accordance with the operation manual. Any deficiencies in the supplies and services provided by Safety Power must be reported by the buyer in writing without delay. These deficiencies will be remedied to the exclusion of any further guarantee claims and rights, accordingly to our warranty statement and our standard terms and conditions. The supplied equipment, excluding the catalyst and labor, is guaranteed for 12 months starting from the date of commissioning and acceptance of the system but no longer than 18 months after delivery or purchase order required ship date. This warranty is not transferable.

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Appendix C – SCR - Brief Description

The exhaust gases from Internal Combustion Engine units that occur during the combustion process and consist primarily of nitrogen oxides (NOx) are directly transferred to the SCR catalytic reactors and a 32.5% aqueous solution of urea is added as reducing agent (SCR technique).

Urea is supplied to the SCR system from a storage tank by means of a feed or proportioning pump. For operation of the engine at one load point only, a fixed quantity of urea is added to the SCR system. In contrast, if the engine is operated at various loads, the quantity of urea fed into the exhaust gas duct upstream of the SCR catalytic reactor can be tailored to the engine power. In this case, a characteristic curve is established during startup for the load-dependent NOx emissions from the engine, which is programmed into the SCR control equipment. The interface between engine and SCR control is formed using the active engine or generator power which is required as standard signal (e.g. 4...20 mA) for the SCR controls. A dry contact signal for "Engine in Operation" must be provided as permissive for the SCR system to operate. After shutdown, the compressed air and voltage supply must be maintained for at least 10 minutes.

The control equipment of the SCR exhaust-gas cleaning system is fully automatic.
Via dry contact signals, the operator can monitor system operation using the signals "SCR System in Operation", "SCR System Fault" and "Low Urea Level". The signal "Low Urea Level" appears when the tank content drops to the minimum level. The SCR system switches off automatically as soon as the tank is empty.

The urea pump is switched on after release by the requirement that "Engine start and exhaust gas temperature > temperature set point downstream of Catalytic Reactor" (at temperatures >572° F/300° C). The urea solution is finely injected into the exhaust gas duct by a binary nozzle using compressed air as auxiliary medium. A suitable compressor must provide compressed air. The urea is converted into ammonia and carbon dioxide in a section of the exhaust gas pipe (mixing duct) designed as an ammonia generator. The mixing duct is installed upstream of the reactor to ensure optimum mixing of the exhaust gas and the ammonia produced from the urea. Please note that exhaust gas temperatures of more than 1022° F/550° C for more than 4 hours may cause damage to the catalyst.

At the SCR catalytic reactor, the nitrogen oxides (NO_x) react with the ammonia (NH_3) to form molecular nitrogen (N_2) and steam (H_2O). The purified air can be let into the atmosphere, passing a heat exchanger installation and the silencer (if installed) downstream of the reactor.

Due to different influences (like type and consumption of lubricating oil, gas quality, urea quality, etc.) clogging of the catalysts may occur. The catalysts may therefore need to be cleaned from time to time using a local compressed air source.

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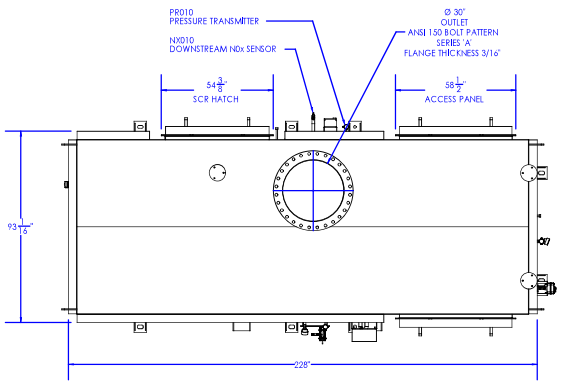
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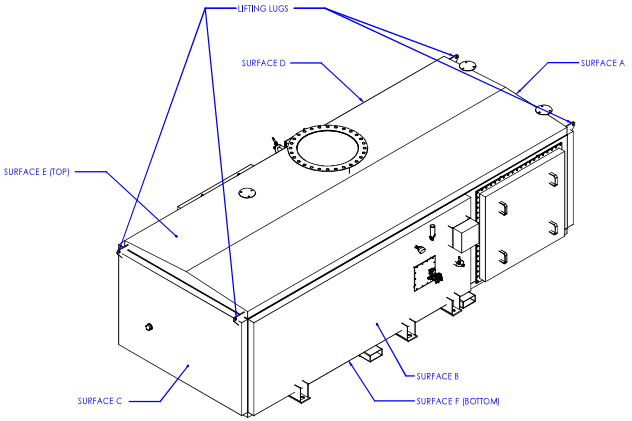
Appendix D – Typical SCR Catalyst



- ✓ 100% homogenous extruded catalyst
- ✓ No wash-coating like other suppliers
- ✓ High surface activity area
- ✓ Pressure-drop is minimized/optimized
- ✓ Honeycomb length and cells is variable
- ✓ Good resistance to thermal shock
- ✓ Good resistance to poisoning
- ✓ Long life-time (hours) of catalyst use

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FOR SYSTEM PERFORMANCE SPECIFICATIONS AND INSTALLATION INFO, PLEASE SEE DWG 99004026 DESIGN CRITERIA - ecoCUBE® MATERIAL: SS409 OR GREATER

SHIPPING DIMENSIONS: H = 78" X L = 242" X W = 111"
SHIPPING WEIGHT: 12200 LBS

DIMENSIONS SHOWN WITH 4" THICK INSULATION EXCEPT BOTTOM SURFACE SHOWN WITH 3" THICK INSULATION

ACCESS CONSIDERATIONS SHOULD BE MADE FOR SERVICING OF THE ecoCUBE® COMPONENTS. IF THE ecoCUBE® REACTOR IS PLACED ON A ROOF OR PLATFORM, EITHER A WALK WAY OR FALL ARREST TIE OFF POINTS SHOULD BE PROVIDED BY OTHERS.

INSTALLER SHALL PROVIDE CLEARANCE AND ACCESS TO ecoCUBE® WITH NECESSARY MAN LIFTS, SCAFFOLDING AND/OR LADDER.

MAINTENANCE ACCESS AREA REQUIREMENTS:

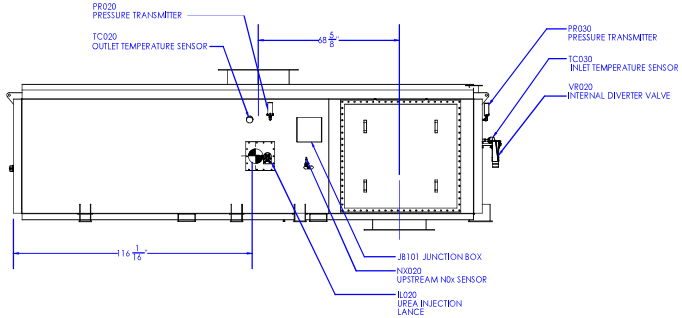
ALLOW MINIMUM 4 FT WIDE ACCESS ON SURFACE A, B, D, & E

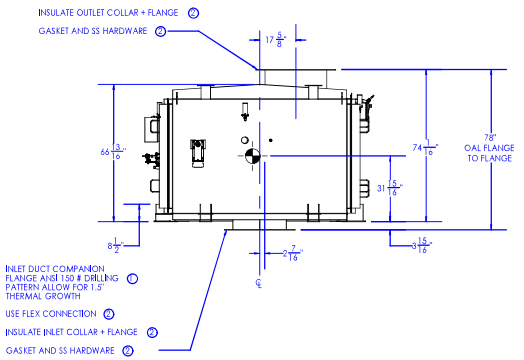
DO NOT OBSTRUCT ACCESS TO: SENSORS (PR, TC, NX), IL020, JB101, ACCESS PANEL, SCR HATCH

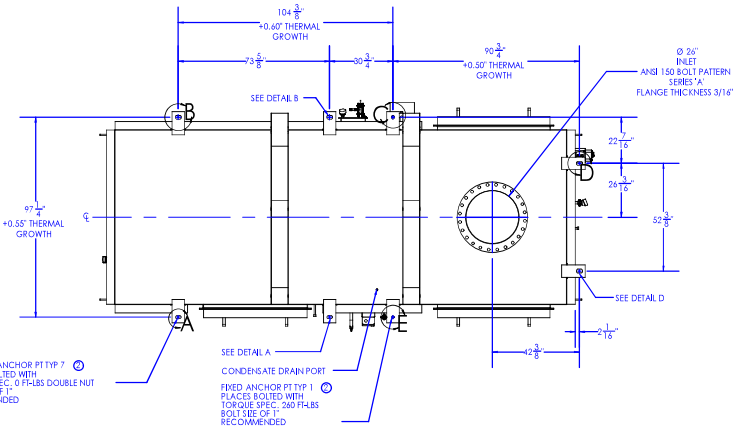
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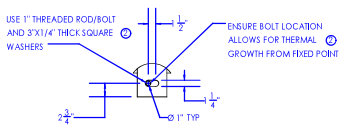
② MATERIAL SUPPLIED AND INSTALLED BY CONTRACTOR

AS BUILT

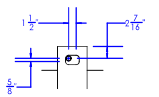




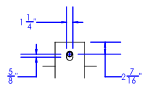




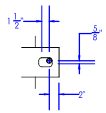
DETAIL A



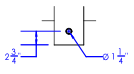
DETAIL B



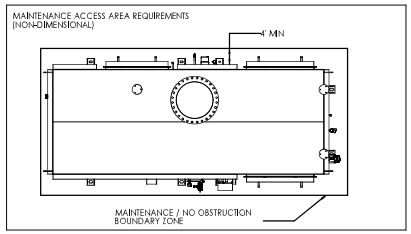
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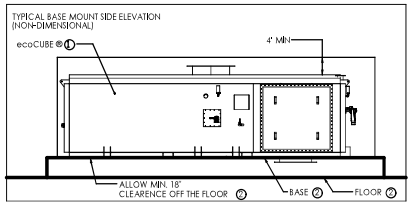


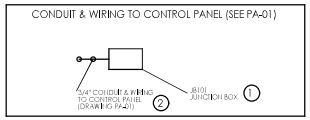
DETAIL D



DETAIL E







FILE NAME: 15572000-2-29 XXXXX DM-01 ecoCUBE Series 5 Rev3 AS BUILT

REVISION		
REV	DESCRIPTION	APVD/DATE
1	FROM TEMPLATE REV11.4 / 22113 DM-01 R1.0:	06 JUL 2023
2	MIRRORRED UNIT, CHANGED OUTLET AND INTLET SIZE AND LOCATION	19 OCT 2023
3	AS BUILT	01 APR 2024

CUSTOMER: Carter CAT

DATE: 01 APR 2024

DRAWING NUMBER: DM-01

TITLE: ecoCUBE® Series 5

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SCALE: NTS

PROJECT NO. XXXXX

ENGINEER: RJ/AL

PLANT:

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APPENDIX D. ENVIRONMENTAL JUSTICE SUMMARY

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COLORADO
Air Pollution Control Division
Department of Public Health & Environment

Environmental Justice Verification Number: 85952234

Jack Peterson
Amazon Data Services, Inc.
DEN-22
Census Block Group: 080050071041

March 14, 2025

Dear Jack Peterson,

We have reviewed the complete Environmental Justice Summary submitted on March 10, 2025 for the DEN-22 facility in census block group 080050071041. Based on this information, the facility is located in a Disproportionately Impacted Community that meets the definition of a Socioeconomically Vulnerable (SV) Community.

Some factors identified during the screening phase warranted further analysis by the Air Pollution Control Division, including the following indicators:

- Housing Cost Burdened Population (above 60% as an absolute metric above the 89th percentile as a relative metric);
- Other Air Pollutants (above the 93rd percentile);
- Proximity to Mining Location (above the 87th percentile);
- Wildfire Risk (above the 80th percentile);
- Population Under 5 Years of Age (above the 97th percentile); and
- Housing Cost Burdened (above the 97th percentile).

These factors may be reviewed and considered further by the Air Pollution Control Division once you submit your complete permit application. Additional information on

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recommended community engagement strategies can be found in The Statement of Basis and Purpose for Air Quality Regulation 3:

> "Sources are encouraged to engage with communities throughout the permitting process to ensure that public concerns are understood and considered, and to provide feedback to both communities and the Division on how public input influenced the proposed project. Community engagement may include holding listening sessions to better understand the concerns of community members, distributing information on the proposed project in plain-language in nearby communities, working with community groups to distribute relevant information, and/or promoting and providing multiple methods for community members to provide input. Potential community groups that applicants should consider contacting include, but are not limited to: neighborhood organizations, schools, clinics, social and activity clubs, libraries, civic associations, businesses, nonprofits, faith-based and secular organizations, and local government(s). And while sources are encouraged to engage in the efforts outlined in Section III.C.5.d. to promote fair treatment and meaningful involvement of disproportionately impacted community members and to provide the Division with documentation of any such efforts undertaken by the source, at this time these components are not substantive application requirements."

We strongly encourage you to prioritize community engagement, outreach, and public participation. For valuable tips and best practices to implement the aforementioned recommendations, visit the CDPHE's website. Please provide documentation for any community engagement efforts as an attachment when you submit the permit

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application.

The Air Pollution Control Division advises you to contact the Community Air Protection and Engagement team to discuss specific community engagement efforts that the facility is highly recommended to conduct for this permit and community. Please email cdphe_apcd_ejreports@state.co.us to coordinate a community engagement consultation.

If outreach is still planned or ongoing after submitting the permit application, you can supplement the permit application with additional updates and documentation after that date. All information will become part of the permit record once submitted to the division as part of the full permit application, including any updates or documentation provided after the initial submission date.

Please note: Since this facility is located in a **Socioeconomically Vulnerable Community**, new community air monitoring fees may apply. Requirement applicability will be determined based on the permit application received. For more information, visit the division's disproportionately impacted community permitting rule web page. If you have questions, email cdphe_apcd_dicmonitoring@state.co.us and cdphe.commentsapcd@state.co.us with "Air Monitoring Requirements" and the facility name in the subject line.

If you have any questions about the Environmental Justice Summary, please email cdphe_apcd_ejreports@state.co.us.

Thank you,

Air Pollution Control Division's Environmental Justice in Permitting Team

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COLORADO
Air Pollution Control Division
Department of Public Health & Environment

Colorado Department of Public Health and Environment

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Number of hours spent on Environmental Justice Summary review and approval: 0.5

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COLORADO
Air Pollution Control Division
Department of Public Health & Environment

Section 1: Background Information (Company/Facility)

1. Company Name

   Amazon Data Services, Inc.

2. Facility Name

   DEN-22

3. Facility Address

   ,

4. Facility Latitude 39.72109

5. Facility Longitude -104.7573

6. Census Block Group(s) in Which the Facility is Located
   080050071041
7. Which Type of Air Permit Will You Be Applying For?
   Construction Permit
8. What specific outcomes or changes will result from the requested permitting action? An increase in emissions
9. Has This Facility Previously Received an Official Permit or Exemption Letter from the Air Pollution Control Division (APCD)?

10. What is the AIRS ID of this facility?
    005-1722
11. What is the permit number exemption number?

Section 2: Environmental Justice Requirements

1. Based on the Environmental Justice Report Generated, is this Facility Located in a Disproportionately Impacted (DI) Community?
   Yes

2. What type of Disproportionately Impacted (DI) Community is the facility located in based on the Environmental Justice Report?
   Socioeconomically Vulnerable (SV) Community

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Section 3: Description of Proposed Permit Application

1. Is the facility an Affected Construction Source?
   No

2. Will this facility emit any Affected Pollutants?
   Volatile organic compounds (VOCs);Nitrogen oxides (NOx);Particulate matter ≤2.5 microns in diameter (PM2.5);Benzene;Toluene;Ethylbenzene;Xylene

3. Provide a brief description of the proposed permit application.
   Amazon Data Services, Inc. is requesting a synthetic minor limit for the Den-22 Campus, including the currently permitted Pad 1 (18 emergency diesel generators) and the proposed Pad 2 (26 emergency diesel generators and 1 house diesel generator).

4. Based on the results of the facility's Environmental Justice Report results and/or engagement with the Disproportionately Impacted Community, describe any:

   a. Mitigation measures;

   b. Emission reduction and control strategies; Mitigation measures include new generators with Tier 4/SCRs to minimize emissions.
   and/or
   c. Changes made to the originally planned source equipment or operations.

Section 4: Public Outreach

1. Did the owner/operator of the facility conduct enhanced community outreach to the impacted community prior to submitting the main permit application?
   No

   a. If the option "Planned, in progress, or to be determined" is chosen: describe any measures that are planned, in progress, or to be determined.

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Part 1: Know the audience, community, and purpose

1. Did you contact residents within at least one-mile radius of the facility to notify them about the proposed permit or project and how they can provide feedback?

2. Did you contact and/or coordinate with any of the following types of organizations or individuals to understand local audiences and the most effective ways to reach them? (Select all that apply.)

3. (Optional) Provide any additional information about the audience, community, and purpose. Also provide the name of any organizations contacted:

Part 2: Host public meetings at various times and days

1. Meeting date:

2. Meeting time:

3. Meeting type: (Select all that apply.)

4. Meeting location(s) (venue name, street address and/or coordinates):

5. Number of registered participants:

6. Number of public participants and community members in attendance:

Part 3: Host public meeting(s) in locations that are safe and accessible

1. If the facility hosted in-person or hybrid meetings, did you choose locations that were: (Select all that apply)

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2. Location accessibility- the location was accessible by: (Select all that apply.)

3. Did you publish meeting and presentation materials on a publicly accessible website?

    a. If yes, please add a link to the website.

4. Did you use a facilitator to keep the meeting on track?

5. (Optional) Provide any additional information about hosting considerations:

Part 4: Provide at least 30 days' notice ahead of public meetings

1. Did you provide at least 30 days' notice ahead of public meetings?

2. Did you provide at least one reminder in advance of the meeting?

Part 5: Actively promote outreach and public participation opportunities

1. Communication tactics used for promoting meetings: (Select all that apply.)

2. Were any of the communication tactics provided in multiple languages?

3. If you selected "yes" to the previous question, please list the languages used in communication tactics and why they were chosen:

4. Did you attend community events or collaborate with trusted partners and organizations to share updates, messages, and public meeting information?

5. (Optional) Provide any additional information about outreach and activities:

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Part 6: Ensure language justice, cultural competency, and accessibility in outreach materials

1. Were meetings made available in multiple languages (interpretation services provided for non-English speakers?)

2. Were meeting materials translated into multiple languages?

3. If interpreters were used, please note the vendor who provided the interpretation:

4. If translation was used, please note the vendor who provided the translation:

5. Were digital accessibility best practices used for web content, digital fliers, social media posts, or other digital communications?

6. (Optional) Provide any additional information about accessibility considerations:

Part 7: Provide various and accessible methods for receiving public feedback

1. Which of the following opportunities and platforms were provided for the public to provide feedback? (Select all that apply).

2. Number of public feedback comments received in writing:

3. Number of public feedback comments received verbally:

4. How did you review public feedback received and use it to inform the proposed project?

5. (Optional) Provide any additional information about public comments received and considered:

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Part 8: Reduce barriers to participation via participation stipends, childcare services, and more

1. Provided for public meeting attendees: (Select all that apply).

2. Included in the public meeting: (Select all that apply).

3. (Optional) Provide a short description of the activities conducted, methods used, and any additional information about reducing barriers for the community:

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COLORADO
Air Pollution Control Division
Department of Public Health & Environment

Air Quality Regulation (Reg.) 3

Environmental Justice Report

Applicant Information

Company Name: Amazon Data Services, Inc.

Facility Name: APA050/APA064

Plant AIRS ID Number: TBD

Permit Type: GP-03

Permit Number: TBD

Facility location used for generating the report: 39.72109 , -104.7573

Environmental Justice Summary

Arapahoe County

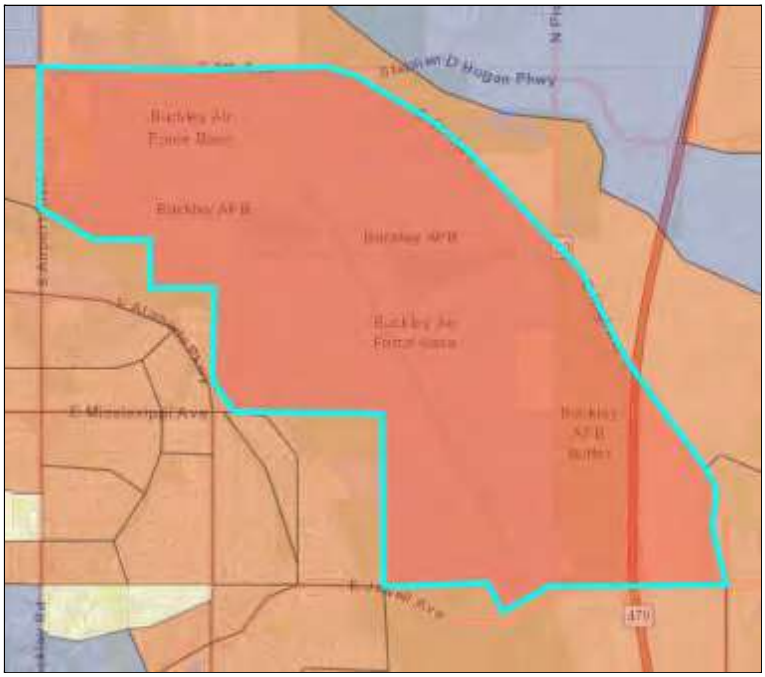
Census Block Group 080050071041

Air Quality Reg. 3 Disproportionately Impacted (DI) Community

Yes

Air Quality Reg. 3 Community Type

Socioeconomically Vulnerable Community



Low-income Population	31.1%
People of Color Population	32.9%
Limited English Proficiency Population	0%
Housing Cost Burdened Population	60.1%
CO EnviroScreen Percentile Score	36.49

Environmental Justice Overview

Environmental Exposures Percentile Score 71.91

The environmental exposures score represents a community's exposure to certain environmental risks relative to the rest of the state. The score ranges from 0 to 100, with higher scores indicating higher burden. The environmental exposures score does not cover all pollutants; it is the average of data on diesel particulate matter, traffic proximity, ozone, PM 2.5, air toxics, other air pollutants, lead exposure risk, drinking water violations, and noise.

Environmental Effects Percentile Score 69.48

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The environmental effects score represents how many hazardous or toxic sites are in a community relative to the rest of the state. The score ranges from 0 to 100, with a higher score indicating higher burden. The score is the average of data on proximity to mining, oil and gas operations, impaired surface waters, wastewater discharge facilities, Superfund sites, facilities that use hazardous chemicals, and facilities that generate, treat, store, or dispose of hazardous wastes.

Climate Vulnerability Percentile Score 33.27

The climate burden score represents a community's risk of drought, flood, extreme heat, and wildfire compared to the rest of the state. The score ranges from 0 to 100, the higher the score, the higher the burden.

Sensitive Populations Percentile Score 5.24

The sensitive populations score captures how at risk a community is to environmental exposures and climate impacts as it relates to health. For example, air pollution has stronger impacts on older and younger people, and people with chronic conditions such as asthma. The score ranges from 0 to 100, with a higher score being worse. The score is calculated using data on asthma hospitalization rate, cancer prevalence, diabetes prevalence, heart disease prevalence, life expectancy, low birth weight rate, mental health, population over 65, and population under 5.

Demographics Percentile Score 47.54

The demographics score represents a community's social and economic vulnerabilities. The score ranges from 0 to 100, with a higher number representing a higher vulnerability. It is calculated using data on people living with disabilities, housing cost burden, educational attainment, limited English proficiency, income, and race and ethnicity.

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One-mile radius with satellite imagery for facility: APA050/APA064



Image above notes a one-mile radius from the location in the center of the circle.

One-mile radius around location used to generate report

An aerial or satellite image of the facility, including a one-mile radius of the surrounding area, is a required component for the Environmental Justice Summary.

This image was generated from the Environmental Justice Report Tool for Air Quality Regulation 3 using the ESRI World imagery basemap. The map features Maxar imagery at 0.3m resolution for select metropolitan areas around the world and 0.5m resolution across the United States. In addition to commercial sources, the World Imagery map features high-resolution aerial photography contributed by the GIS User Community. This imagery ranges from 0.3m to 0.03m resolution (down to ~1:280 in select communities).

For more information, visit: World Imagery

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Pollution and Climate Indicators

Indicator	Original Unit of Measure	Percentile
Air Toxics Emissions	distance weighted measure of estimated air toxics emissions	72.08
Diesel Particulate Matter	micrograms per cubic meter	35.55
Drinking Water Regulations	population weighted duration (in weeks) of resolved and unresolved health based violations from active community public water systems	68.94
Fine Particle Pollution (PM 2.5)	micrograms per cubic meter	67.98
Impaired Streams and Rivers	average impairment and assessment status of streams	73.5
Lead Exposure Risk	percentage of housing units built before 1960, as an indicator of potential exposure to lead	49.66
Noise	decibles A	50.34
Other Air Pollutants	distance weighted measure of estimated other air pollutant emissions	93.69
Ozone	parts per billion	44.9
Proximity to Hazardous Waste Facilities	distance weighted count of hazardous waste facilities within 5 km	51.22
Proximity to Mining Locations	distance weighted measure of the total number of active coal, hard rock, and construction materials mining permits	87.6
Proximity to National Priorities List Sites	distance weighted count of proposed or listed NPL sites with 5 km	65.15
Proximity to Oil and Gas	distance weighted measure of the total number of active oil and gas locations	86.98
Proximity to Risk Management Plan Sites	distance weighted count of RMP facilities within 5 km	77.55
Traffic Proximity and Volume	amount of vehicular traffic nearby, and distance from roads	39.48
Wastewater Discharge Indicator	toxic chemical concentrations in stream segments per km	29.39
Drought	sum of weekly total percent of an area experiencing a severe, extreme, or exceptional drought	13.59
Extreme Heat Days	average number of high heat days between May and September from 2016 to 2020	50.54
Floodplains	percentage of each geographic area where there is at least a one percent chance of flooding annually	76.76
Wildfire Risk	mean wildfire hazard potential within each geographic area as determined by the US Forest Service, 2021	80.04

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Health and Social Indicators

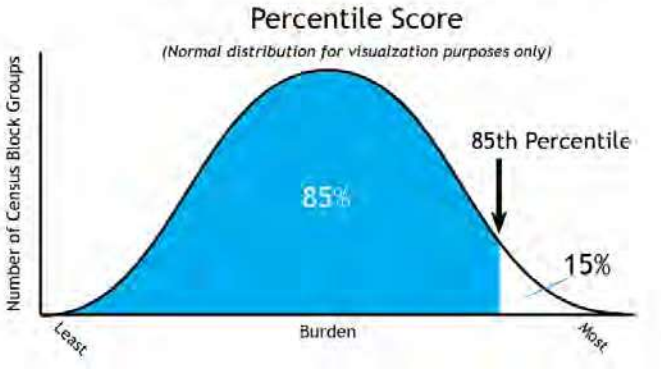
Indicator	Orignial Unit of Measure	Percentile
Asthma Hospitalization Rate	rate of hospitalization per 100,000 people	35.18
Cancer Prevalence	percent of adults	6.24
Diabetes Prevalence	percent of adults	52.71
Heart Disease in Adults	percent of adults	7.15
Life Expectancy	years	28.57
Low Birth Weight	percent of singleton births	49.14
Mental Health Indicator	percent of adults	6.92
Population over 64 years of age	percent of total population	1.44
Population under 5 years of age	percent of total population	97.4
Disability	percent of total population	26.16
Housing Cost Burdened	percent of total population	97.38
Less Than High School Education	percent of total population	12.4
Linguistic Isolation	percent of total population	54.42
Low Income	percent of total population	63.83
People of Color	percent of total population	63.14

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Understanding the Data

The values shown in the Pollution and Climate Indicator and Health and Social Indicator tables are percentiles. Percentiles are a way to see how one area compares to other areas in Colorado. Percentile values range from 0 - 100. A higher score indicates higher burden. Specifically, the percentile tells you the percentage of places in Colorado that have a lower score than the selected location. For example, an area with 85 percentile score for the noise indicator, ranks in the top 15% of areas impacted by noise in Colorado. That means that 85% of the other Census Block Groups in Colorado have a lower score for noise impacts.



The data in the report comes from Colorado EnviroScreen version 1.0. Developed in 2022 by CDPHE and Colorado State University, EnviroScreen maps the overlap of environmental exposures and effects, climate vulnerability, sensitive populations, and demographics to better understand environmental injustice and environmental health risks in Colorado. For more detailed information on the data sources used in Colorado EnviroScreen Version 1.0 see the technical documentation.

On the first page of the report, red text highlights if values for a census block group meet or exceed the criteria for definition of Disproportionately Impacted Community for Air Quality Regulation 3. On subsequent pages of the report, red text highlights indicators in the top percentiles for Colorado that may warrant additional consideration during the permitting process. The Environmental Justice Report is not intended to show individual health risk or exposure.

In the Environmental Justice Summary on the first page, values shown in red indicate a census block group that meets or exceeds the following criteria to qualify as a Disproportionately Impacted (DI) Community for Air Quality Reg 3:

- Over 40% of households are low-income (meaning they are at or below 200% of the federal poverty level),
- Over 40% of the population identify as people of color,
- Over 50% of households are housing-cost burdened (meaning they spend more than 30% of household income on housing costs), or
- Over 20% of the population is linguistically isolated (meaning no adults in a household speak English well).

A census block group that meets or exceeds any of these percentages is labeled as a Socioeconomically Vulnerable Community (SVC).

The CO EnviroScreen Percentile Score, which is also found on the first page of the Environmental Justice Report, is written in red if it is above the 80th percentile. A census block group with a CO EnviroScreen Score above the 80th percentile is labeled as a Cumulatively Impacted Community (CIC).

In other sections of the Environmental Justice Report, including the Environmental Justice Overview, Pollution and Climate Indicators, and Health and Social Indicators sections, indicator and component scores over the 80th percentile

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are also highlighted in red. The 80th percentile threshold is used in most cases to flag census block groups that have indicators and groups of indicators (components) that are in the top 20% of census block groups in Colorado. These indicators and components are flagged because they may warrant further review in the permitting process by the permit applicant and/or the Division staff reviewing the permit.

For most indicators, the indicator is highlighted in red if it is above the 80th percentile to indicate that the census block group where the facility is located faces higher risks based on that indicator compared to other Colorado communities. However, less than 20% of census block groups in Colorado have oil and gas facilities or mining locations. Accordingly, all census block groups in Colorado score above the 80th percentile for proximity to these two types of facilities because even having zero facilities puts a community in the top 20%. Accordingly, the Environmental Justice Report highlights a census block group in red if it is above the 85th percentile for mining facilities and above the 90th percentile for oil and gas facilities. This ensures that only census block groups with a greater number of facilities than the statewide average of zero are highlighted on the EJ Report.

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Colorado EnviroScreen does:

-Show which areas in Colorado are more likely to have higher environmental health injustices.
-Identify areas in Colorado where government agencies can prioritize resources and work to reduce pollution and other sources of environmental injustice.
-Provide information to empower communities to advocate to improve public health and the environment.
-Identify areas that meet the updated definition of "Disproportionately Impacted Community" under House Bill 23-1233 adopted a definition that applies to all state agencies, including CDPHE.
-Identify areas where the Air Quality Regulation (Reg.) Number 3, which governs permitting in disproportionately impacted communities, applies.
-Identify areas that meet the prior definition of "Disproportionately Impacted Community" under the Colorado Environmental Justice Act (HB21-1266).

Colorado EnviroScreen does not:

-Define a healthy or unhealthy environment.
-Establish causal associations between environmental risks and health.
-Define all areas that may be affected by environmental injustice or specific environmental risks.
-Provide information about an individual person's health status or environment.
-Take all environmental exposures into account.
-Tell us about smaller areas within a census block group that may be more vulnerable to environmental exposures than other areas.
-Provide information about non-human health or ecosystem risks.

Additional Resources

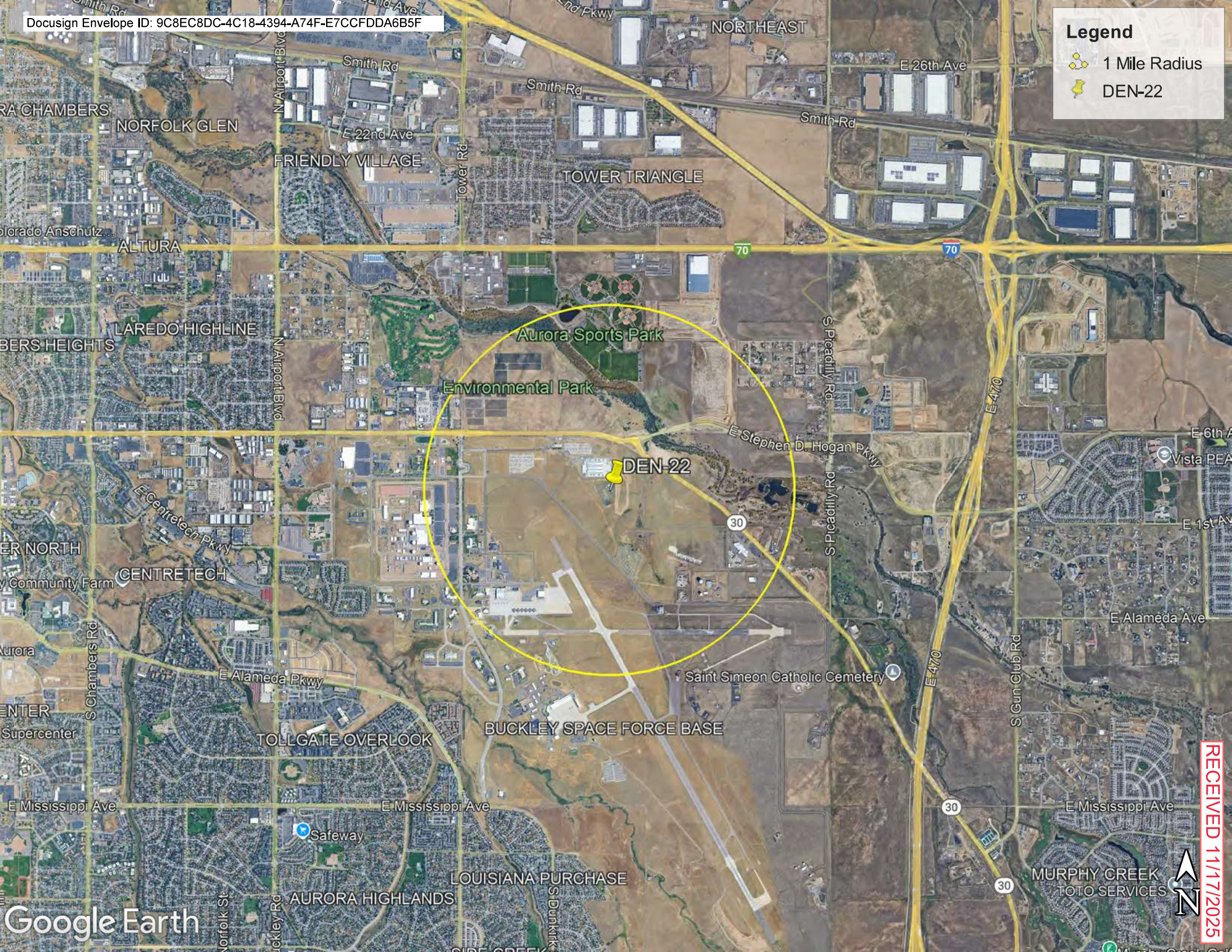
Frequently Asked Questions: Environmental Justice Report Tool for Air Quality Regulation 3

Air Pollution Control Division's Small Business Assistance Program

CDPHE Environmental Justice Program

Colorado EnviroScreen Version 1.0 Reports, Guides, and Resources Folder

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APPENDIX E. FACILITY EMISSIONS INVENTORY FORM (APCD-102A)

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Form APCD-102a

Colorado Department of Public Health and Environment
Air Pollution Control Division

Facility Wide Emissions Inventory Form

Ver. September, 2019

Company Name: Amazon Data Services, Inc.
Source Name: DEN-22
Source AIRS ID: 005-1722

			Uncontrolled Potential to Emit (PTE)															Controlled Potential to Emit (PTE)													
			Criteria (TPY)									HAPs (lbs/yr)						Criteria (TPY)									HAPs (lbs/yr)					
AIRS ID	Permit No.	Description	TSP	PM10	PM2.5	FUG. TSP	FUG. PM10	FUG PM2.5	SO2	NOx	VOC	CO	Benzene	Toluene	EB	Xylene	n-Hex	HCHO	TSP	PM10	PM2.5	FUG. TSP	FUG. PM10	FUG PM2.5	SO2	NOx	VOC	CO	Benzene	Toluene	EB	Xylene	n-Hex	HCHO
001	19AR0178	Type C Generators	0.50	0.50	0.50	0.00	0.00	0.00	0.01	11.76	1.39	6.69	8.94	3.24	0.00	2.22	0.00	0.91	0.50	0.50	0.50	0.00	0.00	0.00	0.01	11.76	1.39	6.69	8.94	3.24	0.00	2.22	0.00	0.91
TBD	TBD	Type B Generator	0.04	0.04	0.04	0.00	0.00	0.00	0.00	0.50	0.07	0.30	0.39	0.14	0.00	0.10	0.00	0.04	0.04	0.04	0.04	0.00	0.00	0.00	0.00	0.50	0.07	0.30	0.39	0.14	0.00	0.10	0.00	0.04
TBD	TBD	Type A Generators	0.58	0.58	0.58	0.00	0.00	0.00	0.02	20.42	1.09	8.21	14.34	5.19	0.00	3.57	0.00	1.46	0.18	0.18	0.18	0.00	0.00	0.00	0.02	12.00	0.66	2.46	14.34	5.19	0.00	3.57	0.00	0.44
		Permitted Sources Subtotal =	**1.12**	**1.12**	**1.12**	**0.00**	**0.00**	**0.00**	**0.03**	**32.68**	**2.56**	**15.20**	**23.68**	**8.58**	**0.00**	**5.89**	**0.00**	**2.41**	**0.72**	**0.72**	**0.72**	**0.00**	**0.00**	**0.00**	**0.03**	**24.26**	**2.12**	**9.46**	**23.68**	**8.58**	**0.00**	**5.89**	**0.00**	**1.39**
APEN Exempt / Insignificant Sources																																		
N/A	N/A	Storage Tanks (exempt per Regulation 3, Part A, II.D.1.fff.)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		Insignificant Subtotal =	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.1**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.1**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
		Total, All Sources =	**1.1**	**1.1**	**1.1**	**0.0**	**0.0**	**0.0**	**0.0**	**32.7**	**2.6**	**15.2**	**23.7**	**8.6**	**0.0**	**5.9**	**0.0**	**2.4**	**0.7**	**0.7**	**0.7**	**0.0**	**0.0**	**0.0**	**0.0**	**24.3**	**2.2**	**9.5**	**23.7**	**8.6**	**0.0**	**5.9**	**0.0**	**1.4**

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APPENDIX F. COMPANY CONTACT FORM (APCD-101)

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Form APCD-101

COLORADO
Department of Public Health & Environment

Company Contact Information Form

Ver. September 10, 2008

Company Name: Amazon Data Services, Inc.

Source Name: DEN-22

Permit Contact[1]:	Dan Glazer		
Address:	19650 Winter Park Ave		
	Street		
	Aurora	CO	80011
	City	State	Zip
Phone Number:	(216) 789-4685		
Fax Number:			
E-mail:	deglazer@amazon.com		

Compliance Contact[2]:	Collin Valdez		
Address:	7400 Potranco Rd		
	Street		
	San Antonio	TX	78251
	City	State	Zip
Phone Number:	(210) 833-7350		
Fax Number:			
E-mail:	valdezec@amazon.com		

Billing Contact: *(Permit Fees)[3]*	Dan Glazer		
Address:	(Same as Above)		
	Street		
	City	State	Zip
Phone Number:			
Fax Number:			
E-mail:			

Billing Contact: *(Annual Fees)[4]*	Collin Valdez		
Address:	(Same as Above)		
	Street		
	City	State	Zip
Phone Number:			
Fax Number:			
E-mail:			

Check how would you like to receive your permit fee invoice?

Mail: ☐ E-mail: ☒ Fax: ☐

Footnotes:

[1] The permit contact should be the point of contact for technical information contained in the permit application. This may be a company representative or a consultant.

[2] The compliance contact should be the point of contact for discussing inspection and compliance at the permitted facility.

[3] The billing contact (Permit fees) should be the point of contact that should receive the invoice for fees associated with processing the permit application & issuing the permit. (Reg. 3, Part A, Section VI.B)

[4] The billing contact (Annual fees) should be the point of contact that should receive the invoices issued on an annual basis for fees associated with actual emissions reported on APENs for the facility. (Reg. 3, Part A, Section VI.C)

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Signatures: 5
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ATTN: Legal Department
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Dan Glazer deglazer@amazon.com Security Level: Email, Account Authentication (None)	COPIED	Sent: 11/6/2025 9:29:40 PM Viewed: 11/7/2025 9:33:24 AM

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Steve Botic stebotic@amazon.com Security Level: Email, Account Authentication (None) **Electronic Record and Signature Disclosure:** Not Offered via Docusign	COPIED	Sent: 11/6/2025 9:29:41 PM
Garrett Koehler gkoehl@amazon.com Security Level: Email, Account Authentication (None) **Electronic Record and Signature Disclosure:** Not Offered via Docusign	COPIED	Sent: 11/6/2025 9:29:41 PM Resent: 11/6/2025 9:29:55 PM
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Shannon Khounnala khounnal@amazon.com Security Level: Email, Account Authentication (None) **Electronic Record and Signature Disclosure:** Not Offered via Docusign	COPIED	Sent: 11/6/2025 9:29:41 PM

Witness Events	Signature	Timestamp

Notary Events	Signature	Timestamp

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AIR DISPERSION MODELING ANALYSIS

Amazon Data Services – DEN22

AIRS 005-1722

Prepared By:

TRINITY CONSULTANTS
1999 Broadway, Suite 820
Denver, CO 80202
(720) 638-7647

October 2025

Project 240601.0149

Trinity Consultants

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1. EXECUTIVE SUMMARY

Amazon Data Services, Inc. (Amazon) owns and operates the DEN-22 Campus (DEN-22, Facility AIRS ID 005-1722) in Arapahoe County which provides back-up electric power. DEN-22 is authorized under Construction Permit 19AR0178, Issuance 3 (issued November 3, 2023) and is located at 19650 Winter Park Ave, Buckley Space Force Base, CO 80011.

DEN-22 is permitted for eighteen (18) diesel-fired emergency generator engines that provide mechanical power to electrical generators. With this application, Amazon is requesting to build Pad 2 as a modular addition which will consist of twenty-six (26) new diesel-fired emergency generator engines and one (1) house generator. Pad 2 is proposed to begin operation in the fourth quarter of 2026.

A Modeling Requirements Determination Form APCD-114 was submitted as a part of the construction permit application on August 12, 2025. Per the modeling requirement determination received from the CDPHE on August 26, 2025, compliance with the 1-hour nitrogen dioxide (NO_2), 1-hour carbon monoxide (CO), 8-hour CO, and 24-hour particulate matter less than two and a half microns ($PM_{2.5}$) Colorado Ambient Air Quality Standards (CAAQS) and National Ambient Air Quality Standards (NAAQS) must be demonstrated.

This document describes the modeling methodology and results used to conduct the required NAAQS compliance demonstrations. The modeling methods employed provide conservative estimates of ambient concentrations that may potentially result from project emissions.

The analysis was conducted in accordance with guidance provided by the United States Environmental Protection Agency (EPA) and CDPHE as outlined in the following documents:

- Guideline on Air Quality Models (published as 40 CFR 51, Appendix W; hereafter referred to as the Modeling Guideline)[1]
- Colorado air quality modeling guidelines[2]

[1] Code of Federal Regulations, Title 40 – Protection of Environment, Part 51, Appendix W, November 29, 2024.

[2] *Colorado Minor NSR Source Modeling Guidance for Air Quality Permits*. March 2025.

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2. MODELING METHODOLOGY

2.1 Model Selection

Selection of the appropriate dispersion model is based on the available meteorological input data, the physical characteristics of the emission unit that is to be simulated, the land use designation in the vicinity of the facility, the complexity of the nearby terrain, and applicable guidance to be used for demonstrating compliance with applicable air quality standards and thresholds.

Trinity used the current version of the Environmental Protection Agency (EPA)-approved American Meteorological Society/EPA Regulatory Model (AERMOD) modeling system to meet the dispersion modeling requirements. AERMOD is recommended for use in modeling multi-source emissions, and can account for plume downwash, stack tip downwash, and point, area, and volume sources.[3, 4]

Current version numbers of the AERMOD model and preprocessors[5] that were used are:

- AERMAP Version 24142
- AERMOD Version 24142
- BPIPPRM Version 04274

2.2 Model Input Options

Model input options were set to their regulatory default values.

2.3 Urban Source Classification

A qualitative Auer land-use analysis, as described in Section 7.2.1.1(b)(i) of the Modeling Guideline[4] was conducted to determine the appropriate dispersion coefficients to use in the AERMOD model. The qualitative land use analysis was performed using aerial imagery from Google Earth. No area within a 3-kilometer (km) radius of the project location could be classified as land use types I1, I2, C1, R2, or R3 [heavy industrial, light/moderate industrial, commercial, compact residential (single family), or compact residential (multi-family), respectively]. Therefore, the URBANOPT keyword in AERMOD was not used.

2.4 Plume Downwash

The emission sources for the proposed project were evaluated in terms of their proximity to nearby structures. The purpose of this evaluation is to determine if the stack discharges might become caught in the turbulent wakes of these structures. Wind blowing around a building creates zones of turbulence that are greater than if the building was absent. AERMOD incorporates the Plume Rise Model Enhancements (PRIME) algorithms for estimating enhanced plume growth and restricted plume rise for plumes affected by building wakes.

---

[3] User's Guide for the AMS/EPA Regulatory Model - AERMOD (EPA-454/B-22-007). Office of Air Quality Planning and Standards. November 2024.

[4] Code of Federal Regulations, Title 40 – Protection of Environment, Part 51, Appendix W, November 29, 2024.

[5] Because the CDPHE provided AERMOD-ready meteorological data (see Section 2.5), meteorological data processing was not required of Amazon for this project.

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EPA has promulgated stack height regulations that restrict the use of stack heights in excess of "Good Engineering Practice" (GEP) in air dispersion modeling analyses. Under these regulations, that portion of a stack in excess of the GEP height is generally not creditable when modeling to determine source impacts. This essentially prevents the use of excessively tall stacks to reduce the ground-level pollutant concentrations. The GEP stack height is defined by the following formula:

$$H_{GEP} = H + 1.5L$$

Where:
H_{GEP} = GEP stack height,
H = structure height, and
L = lesser dimension of the structure (height or projected width).

This equation is limited to stacks located within 5L of a structure. Stacks located at a distance greater than 5L are not subject to the wake effects of the structure. If there is more than one stack at a given facility, the above equation must be successively applied to each stack. If more than one structure is involved, the equations must also be successively applied to each structure. In general, the lowest GEP stack height for any source is 65 m by default.[6]

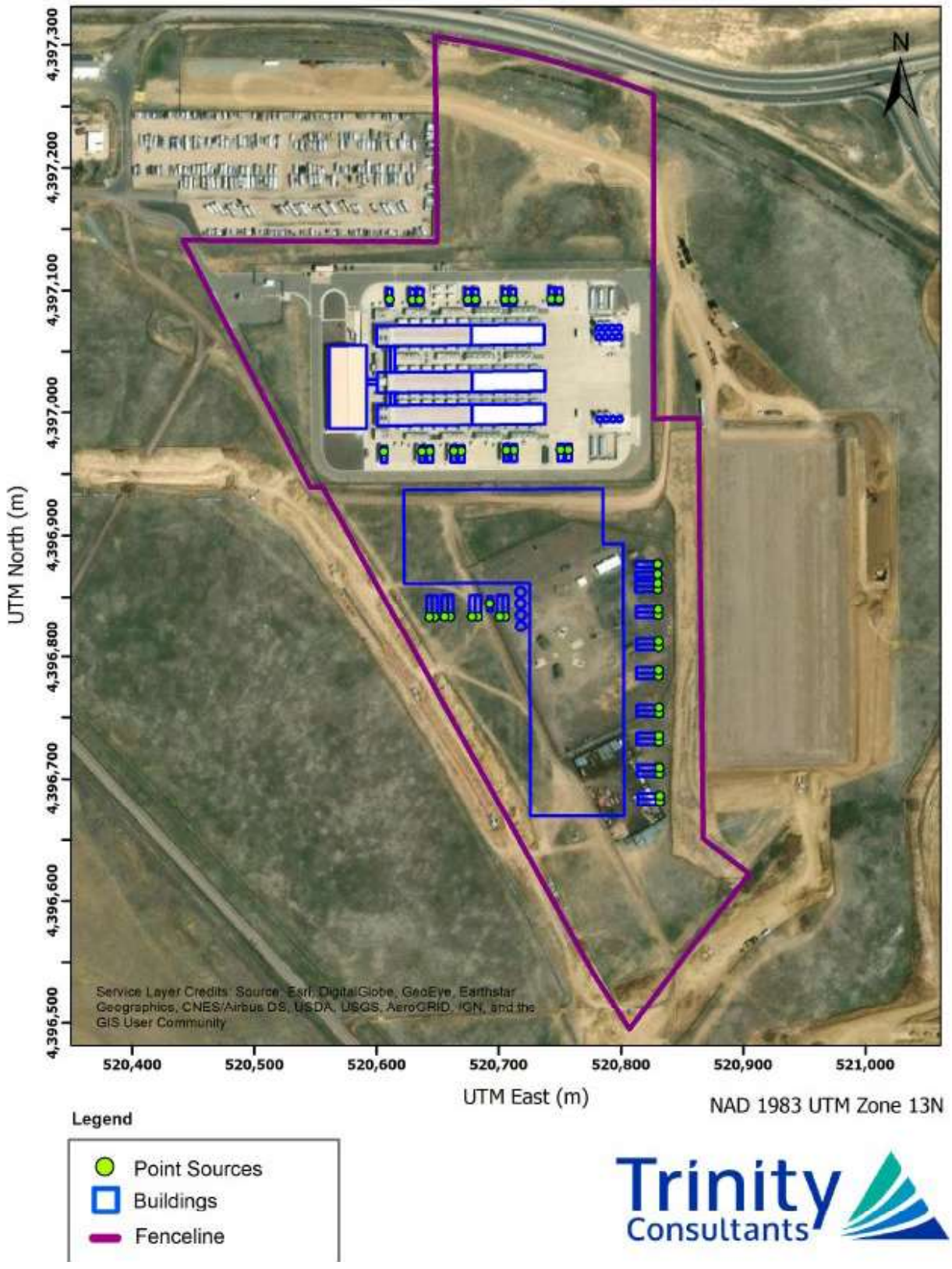
Direction-specific building dimensions and the dominant downwash structure parameters used as inputs to AERMOD were determined using the current version of BPIPPRM. The output from the BPIPPRM downwash analysis lists the names and dimensions of the structures generating wake effects and the locations and heights of the affected emission sources (i.e., stacks). In addition, the output contains a summary of the dominant structure for each emission unit (considering all wind directions) and the actual building height and projected widths for all wind directions. This information was input to the AERMOD air dispersion model for each point source.

A simplified plot plan of the facility showing the locations of all proposed structures and emission units used in the plume downwash calculations is provided in Figure 2-1. The facility structure and source base elevations extracted from the grading plan are contained in the electronic BPIPPRM and AERMOD input/output files contained in Appendix C.

[6] 40 CFR §51.100(ii)

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Figure 2-1. Modeled Downwash Structures and Stacks



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2.5 Meteorological Data

Hourly meteorological data used for air quality modeling must be spatially and climatologically representative of the area of interest. The Modeling Guideline requires a minimum of one year of site-specific meteorological data or five years from the most recent, readily available data collected at the nearest National Weather Service (NWS) station. The Modeling Guideline states that if one year or more years (up to 5 years) of site-specific data are available, these data are preferred for use in air quality analyses.

CDPHE provided 5 years of AERMOD-ready meteorological data consisting of surface data from the Denver International Airport (i.e., NWS data) and upper air data from KDEN.[7] The data were processed by CDPHE using the current version of AERMET (Version 24142).

When updates to the Modeling Guideline were promulgated in 2017, EPA adopted the use of ADJ_U* as a regulatory option when using NWS airport meteorological data, site-specific meteorological data without turbulence parameters, or prognostic meteorological data. Using ADJ_U* in NWS meteorological data processing is recommended to address model overprediction issues during light wind, stable conditions. Therefore, the Denver International Airport dataset processed with the ADJ_U* option was used for this analysis.

2.6 Ambient Air Boundary

This Facility is located on leased land within a base. Security includes a combination of technology and personnel. Any member of the public who comes onto the property is monitored and removed if they should not be present. Additionally, the base as a whole is secured by perimeter fencing and access is restricted to authorized personnel only. As such, the public does not reasonably have access to the property, and the property boundary is the appropriate starting point for ambient air assessment and receptor placement at this facility.

2.7 Receptor Network and Terrain Elevations

Cartesian receptor grids centered on the facility were defined using Universe Transverse Mercator (UTM) Zone 13 North American Datum (NAD83) coordinates. For purposes of air dispersion modeling, the NAD83 spatial reference system is equivalent to WGS84.[8] The grids were designed to resolve the highest predicted pollutant impacts while at the same time allowing for reasonable execution time. Several receptor grids of varying resolution were defined for the significant impact analysis with more conservative resolution than the CDPHE modeling guideline. The significant impact analysis grids consist of a set of nested receptors placed at:

- A grid containing 25-meter spaced receptors extending 300 meters from the facility boundary.
- A grid containing 50-meter spaced receptors extending from 300 meters to 1,000 meters from the facility boundary.
- A grid containing 100-meter spaced receptors extending from 1,000 meters to 2,000 meters from the facility boundary.

[7] CDPHE provided AERMOD-ready meteorological data site on September 22, 2025. A copy of the meteorological determination is provided in Appendix A.

[8] See AERMAP User's Guide (EPA 454/B 18 004), Section 2.1.

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- A grid containing 200-meter spaced receptors extending from 2,000 meters to 5,000 meters from the facility boundary.
- A grid containing 500-meter spaced receptors extending from 5,000 meters to 10,000 meters from the facility boundary.
- A grid containing 1,000-meter spaced receptors extending from 10,000 meters to 50,000 meters from the facility boundary.

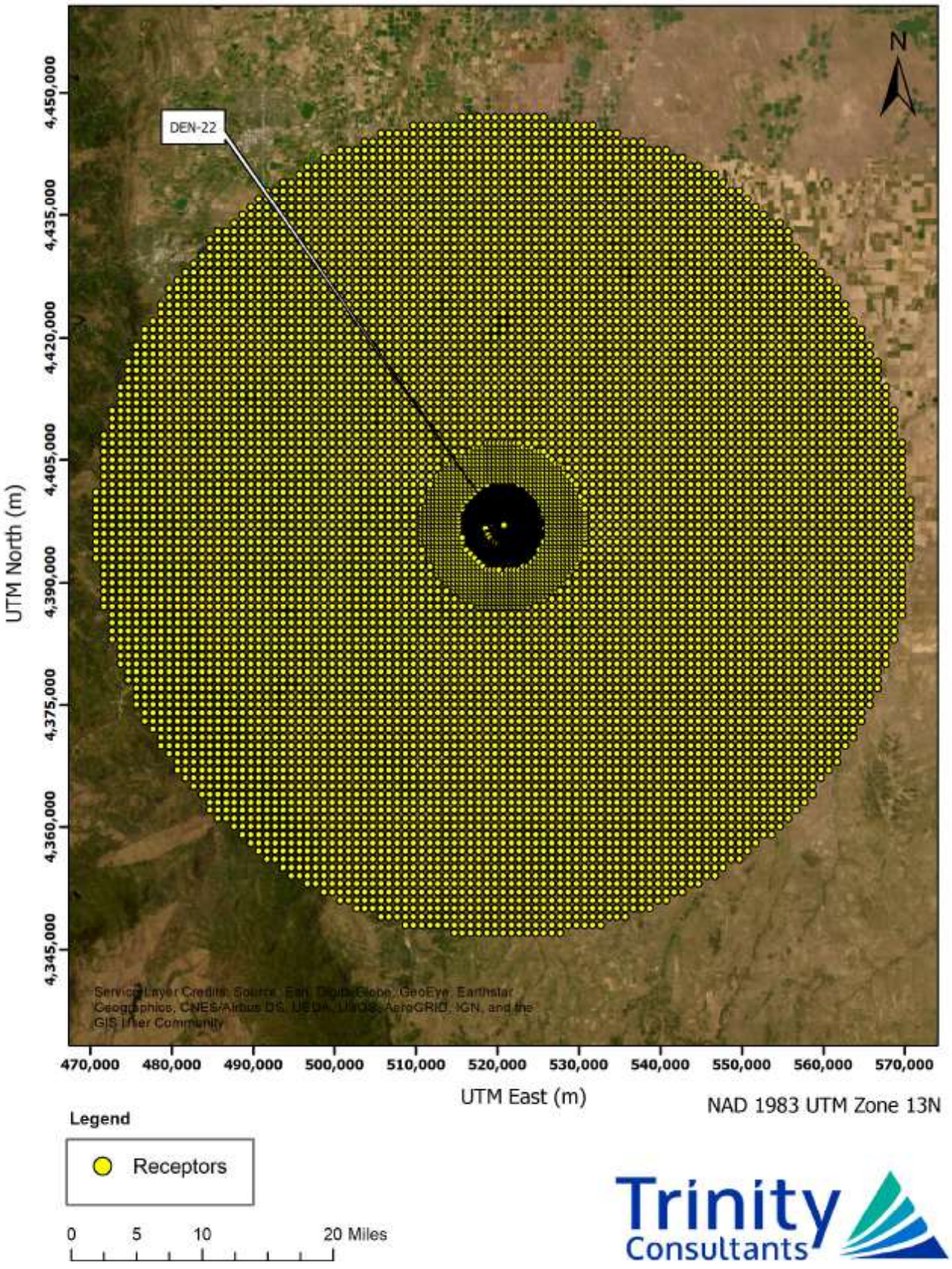
In addition, 10-meter spaced receptors are included along the property boundary. All receptors are placed at ground level elevation, as calculated using the AERMOD preprocessor, AERMAP version 24142. All modeled receptors are shown in Figure 2-2 and Figure 2-3.

According to EPA guidance, the elevation array and domain boundary for AERMAP must include all terrain features that exceed a 10 percent elevation slope from any given receptor in order to properly calculate the hill height scale at each receptor. The domain for the hill height scale analysis, via the extent of the extracted NED data set, extends to a minimum of 50 km from the facility, which is sufficient to meet the elevation slope requirement.

When cumulative impact analyses are required, all the receptors were modeled for the subject significant pollutant and averaging period.

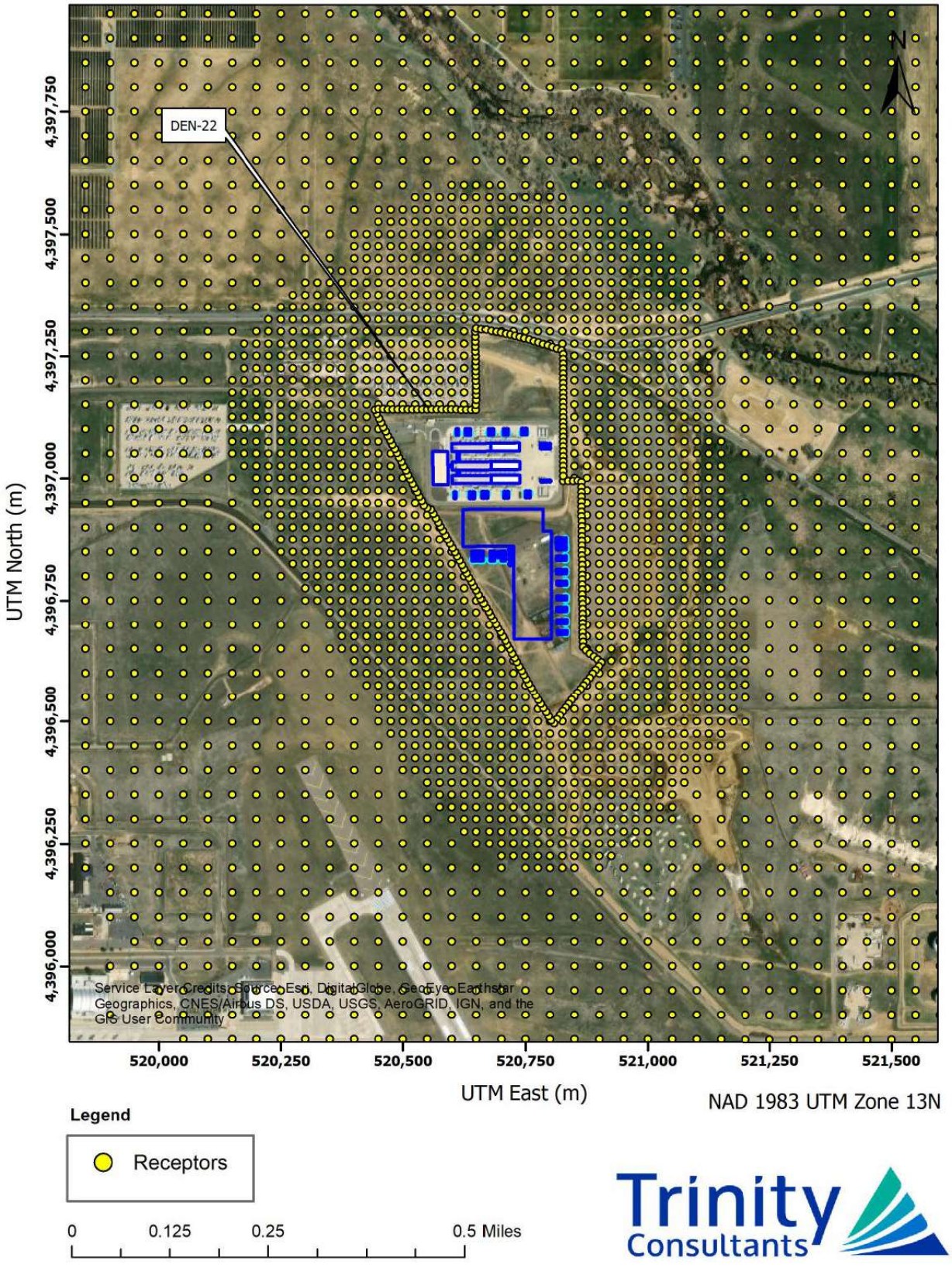
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Figure 2-2. DEN-22 Topographic Map: Full Domain



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Figure 2-3. DEN-22 Topographic Map: Boundary Receptors



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2.8 Background Concentrations

The portion of the background air quality that accounts for Other Sources as defined in 40 CFR 51, Appendix W, Section 8.3.1.(ii) [i.e., emission sources other than those that would be explicitly modeled under Section 8.3.1.(i)], must be characterized by ambient monitoring data. Other Sources are defined as the portion of the background attributable to natural sources, other unidentified sources in the vicinity of the project, and regional transport contributions from more distant sources (domestic and international).

The CDPHE provided representative background concentrations to account for Other Sources for all pollutants and averaging periods.[9] The following background concentrations were used in the cumulative impact analysis.

Table 2-1. Background Concentrations

Pollutant	Averaging Period	Concentration [a] ($\mu g/m^3$)	Basis
NO_2	1-hour [b]	Seasonal	La Casa, 2017-2021
	Annual	28.2	La Casa, 2022-2024
O_3	8-hour [b]	Seasonal	La Casa, 2017-2021
$PM_{2.5}$	24-hour	14.6	La Casa, 2022-2024 (Smoke Adjusted)
	Annual	5.5	
CO	1-hour	2,061.2	La Casa, 2022-2023
	8-hour	1,603.1	

[a] See letter dated September 22, 2025 to H. Warlick (Trinity) from the CDPHE Permit Modeling Unit found in Appendix A. The background concentrations provided by CDPHE in parts per million (ppm) were converted to micrograms per cubic meter ($\mu g/m^3$) using standard temperature and pressure of 25 degrees Celsius and 760 millimeters of mercury, respectively.

[b] The seasonal NO_X and ozone background concentrations for use in the Generic Reaction Set Method (GRSM) were provided in email dated September 29, 2025 to H. Warlick (Trinity) from the CDPHE Permit Modeling Unit and can be found in Appendix A.

2.9 NO_X-to-NO_2 Treatment

Some forms of emitted NO_X [i.e., nitrogen oxide (NO)] will react with other atmospheric constituents (ozone) to form NO_2. These reactions are complex and depend on factors such as mixing of ambient air into the plume, individual reaction rates, and the concentration of specific reactants in the atmosphere. Regulatory dispersion models such as AERMOD are designed to model impacts of non-reactive pollutants, but there are various modeling techniques that can be used to estimate ambient NO_2 impacts using these models. EPA's Modeling Guideline describes a three-tiered screening approach to calculating NO_2 concentrations based on dispersion model predictions of NO_x Concentrations.

The three tiers, arranged in order from simplest to most refined, are:

- Tier 1 – Assume full conversion of NO to NO_2, so that the NO_x predicted by AERMOD is 100% NO_2.
- Tier 2 – Ambient Ratio Method (ARM), where model predicted NO_x concentrations are multiplied by a NO_2/NO_x ambient ratio, derived from ambient monitoring data.

[9] A copy of this determination is provided in Appendix A.

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- Tier 3 – More detailed methods that account for the plume dispersion and chemistry may be considered on a case-by-case basis, including the Ozone Limiting Method (OLM), the Plume Volume Molar Ratio Method (PVMRM), and Generic Reaction Set Method (GRSM)[10]

The 1-hr NO_2 analysis for this Facility used the Tier 3 GRSM methodology. PVMRM and OLM do not address the photolytic conversion of NO_2 to NO or address the time-of-travel necessary for NO_x plumes to disperse and convert the NO portion of the plume to NO_2 via titration and entrainment of the ambient zone. This can overpredict NO_2 impacts for some source characterizations and model configurations at the project source ambient air boundaries and within the first 1-3 km. Therefore, GRSM was selected to more accurately represent the conversion of NO to NO_2 at and near the facility's boundary. All regulatory defaults were maintained when utilizing the GRSM method in this assessment and applicable NO_X and ozone background concentrations were approved and provided by the CDPHE.

The use of GRSM requires in-stack ratios (ISRs) of NO_2 to NO_x to be specified for modeled sources. An ISR of 0.1 was selected for all generators at the Facility. This ISR is aligned with other recent approved data center analyses, and is a conservative value based on EPA's ISR database for uncontrolled engines firing diesel or kerosene.[11]

2.10 Source Characterization

2.10.1 Facility Description

The DEN-22 data center will house computer systems and associated components, such as telecommunications and data storage systems. The facility includes data communications equipment, security systems, environmental controls, and diesel-fueled backup power generators. The principal use of the facility will be the storage, management, and dissemination of electronic data.

Processes that will emit air pollutants include the diesel-fueled emergency backup generators that will be used in the event of a loss of power. Emergency backup power is the only purpose of the generators.

All engines will be fueled with ULSD and/or renewable diesel meeting ULSD sulfur standards. The diesel-fired emergency generators engines have a maximum rated horsepower of 2,500 kW for the Pad 1 generators (currently permitted), 2,000 kW for the Pad 2 house engine (proposed), and 2,750 kW for the Pad 2 generators (proposed). The manufacturer has indicated that at the site elevation, the units are capable of achieving up to 85% load. Therefore, for the sake of emissions estimates, manufacturer data was used up to 85% load.

The generator engines are subject to the federal New Source Performance Standards (NSPS) for Compression Ignition Internal Combustion Engines (40 CFR 60 Subpart IIII). All Pad 2 generators are compliant with Tier 4 standards and the Pad 2 House and Pad 1 generators are certified to Tier 2 standards. The Pad 2 generators also use an add-on control system known as a catalyzed diesel particulate filter (cDPF) which combines a diesel oxidation catalyst with a diesel particulate filter for one point of measured

[10] GRSM was added to *EPA's User's Guide for the AMS/EPA Regulatory Model (AERMOD)* pulished November 2024.

[11] Filtered available entries in Excel file "NO_2_ISR_database.xlsx", EPA NO_2/NO_X in-stack ratio database, available at https://www.epa.gov/scram/nitrogen-dioxidenitrogen-oxide-stack-ratio-isr-database, accessed September 9, 2025. The average ISR for RICE firing diesel or kerosene is 0.07.

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control. Additionally, these generators will be equipped with selective catalytic reduction (SCR) as part of their control system package.

2.10.2 Modeled Sources

The emission units at the facility are:

- Type A.1 (Pad 2): 26 Caterpillar 3516E 2,750 kW generators [uncontrolled (Tier 4)],
- Type A.2 (Pad 2): 26 Caterpillar 3516E 2,750 kW generators with SCR and cDPF [controlled (Tier 4)],
- Type B (Pad 2): 1 Caterpillar 3516C 2,000 kW generator (Tier 2), and
- Type C (Pad 1): 18 Caterpillar 3516C 2,500 kW generators (Tier 2).

Elevations for the sources are set to the graded building base level of the associated building. A map showing the location of the emission sources is included in Figure 2-1.

2.10.3 Operating Scenarios

Non-emergency operation of the emergency generators is limited by federal regulations to 100 hours/year/generator.[12]

Data centers are intermittent sources whose emissions vary substantially and frequently on a day-to-day or even an hour-to-hour basis. Therefore, representation of data center emissions using a continuous emission rate across the time domain of the model will result in a drastic overestimation of modeled impacts from the data center for all sources. Amazon will conduct routine testing and maintenance (T&M) on the backup generators to ensure those units will operate appropriately in the event of an emergency. Because emergency events in this area are typically extremely rare and short-lived, annual data center emissions at other Amazon facilities are very low, and the same circumstances are expected for DEN-22. When data center emissions do occur, they result primarily from these brief and variable T&M activities. For tests that occur at 0% load, emission rates and stack dispersion parameters for 10% load are used.

The following scenarios for T&M are used for the modeling analysis:

Confidence testing (CT): Confidence tests will last 6 minutes for each generator and will be performed at 0% load for all units. Confidence testing will occur biweekly for each generator. NO_X emissions from the Tier 2 units with add-on control technology will be uncontrolled during this test. $PM_{2.5}$ will be controlled for the entirety of the test.

- For the 18 Pad 1 generators and the 26 Pad 2 generators, a maximum of a half building (i.e., 9-13 generators) could run simultaneously in any hour. A maximum of one building will be tested in the same day.
- For the house generator, the test can occur on the same day but not within the same hour.

Preventive Maintenance (PM) testing: PM tests will last 10 minutes for each generator and will be performed at 0% load for all units. The PM test will occur once per year per generator. NO_X emissions from the Tier 2 units with add-on control technology will be uncontrolled during this test. $PM_{2.5}$ will be controlled for the entirety of the test.

- For the 26 Pad 2 generators, up to three generators will run in any one hour. A maximum of 8 to 10 generators will be tested in the same day, and all generators tested in a given day will be located at the same building.

[12] 40 CFR 60, Subpart IIII; 40 CFR 63 Subpart ZZZZ.

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- For the house generator, the test can occur on the same day but not within the same hour.

Load Bank (LB) testing: Annual LB tests will last 42 minutes for each generator. All generators will undergo the same testing scenario, except for the catcher generators located at each data center. These generators will be equipped with an integrated load bank to perform this testing; a load bank is a piece of equipment that is used to simulate an electrical load to test the power source without connecting it to its normal operating load (i.e., the data center). The load bank is physically limited to operation up to 50% load; this is the cause for the difference in operating scenarios. A total of four (4) catcher generators will be available at the DEN-22 campus, consisting of 2 Type A.1/A.2 and 2 Type C.

LB testing will be completed on all generators, other than the catchers, at the following operating loads:
- 10% Load for 6 minutes
- 50% Load for 24 minutes
- 85% Load for 6 minutes (controlled for units with aftertreatment systems)
- 10% Load for 6 minutes (controlled for units with aftertreatment systems)

LB testing for the catchers will be completed at the following loads:
- 10% Load for 6 minutes
- 50% Load for 30 minutes (the last 6 minutes will be controlled for units with aftertreatment systems)
- 10% Load for 6 minutes (controlled for units with aftertreatment systems)

Stack dispersion parameters and emission rates are the weighted average rate at each of the corresponding operating loads. In the first 30 minutes of the test for the Tier 2 generators with add-on control technology, NO_X will be uncontrolled and the remaining 12 minutes will be controlled. This control technology downtime corresponds with the time required for the engines to achieve the necessary temperatures required for effective use of the SCR. $PM_{2.5}$ will be controlled for the entirety of the test.
- For the 26 Pad 2 generators, only one generator will run during any given hour. A maximum of 8 to 10 generators will be tested in the same day, and all generators tested in a given day will be located at the same building.
- For the house generator, the test can occur on the same day but not within the same hour.

Annual Live Load Transfer Test (LLT): Annual LLTs will last 30 minutes for each generator and will be performed at 40-85% load for all units. The annual LLT will occur once per year per generator. In the first 15 minutes of the test for the Tier 2 generators with add-on control technology, NO_X will be uncontrolled and the remaining 15 minutes will be controlled. This control technology downtime corresponds with the time required for the engines to achieve the necessary temperatures required for effective use of the SCR. $PM_{2.5}$ will be controlled for the entirety of the test.
- For the 26 Pad 2 generators, only one generator will run during any given hour. A maximum of 8 to 10 generators will be tested in the same day, and all generators tested in a given day will be located at the same building.
- For the house generator, the test can occur on the same day but not within the same hour.

For each scenario, modeled emission rates are consistent with a full hour of operation then adjusted for the length of run time using the variable emission factors function in AERMOD. The "HROFDAY" parameter is used to adjust the emission rate based on the length of each scheduled run to accurately reflect expected operating time.

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2.10.4 Stack Dispersion Parameters

The stack parameters used to model emissions are obtained from manufacturer specifications. Stack orientation, diameter, and height are provided in Table 2-2. The stack parameters for each operating scenario are provided in Table 2-3. All sources are modeled using the "POINT" source type.

Table 2-2. Summary of Exhaust Stack Physical Configuration for All Scenarios

Sources		Generator Type	Stack Configuration	Model Source Type	Stack Height (m)	Stack Diameter (m)
Pad 2 Generators (26)	CAT 3516E 2,750 kW	Type A.1/A.2	Vertical/No Obstruction	POINT	13.41	0.61
Pad 2 House Generator (1)	CAT 3516C 2,000 kW	Type B	Vertical/No Obstruction	POINT	13.41	0.36
Pad 1 Generators (18)[a]	CAT 3516C 2,500 kW	Type C	Vertical/No Obstruction	POINT	4.67	0.46
					11.89	0.46

a. Pad 1 Generators have 2 different stack heights, with an equal number of each type (9).

Table 2-3. Summary of Exhaust Stack Dispersion Parameters for All Scenarios

Stack Parameter	Engine	Generator Type	CT	PM	LB	LLT
Temperature (K)	Pad 2 Generators – 2,750 kW	Type A.1/A.2	608.93	608.93	690.09	728.43
		Type A.1/A.2 (Catcher)	608.93	608.93	689.05	728.43
	Pad 2 House Generator – 2,000 kW	Type B	562.48	562.48	606.54	645.98
	Pad 1 Generators – 2,500 kW	Type C	567.93	567.93	655.55	709.04
		Type C (Catcher)	567.93	567.93	652.25	709.04
Velocity (m/s)	Pad 2 Generators – 2,750 kW	Type A.1/A.2	9.29	9.29	20.13	31.33
		Type A.1/A.2 (Catcher)	9.29	9.29	18.90	31.33
	Pad 2 House Generator – 2,000 kW	Type B	21.28	21.28	42.96	65.43
	Pad 1 Generators – 2,500 kW	Type C	12.73	12.73	29.58	47.06
		Type C (Catcher)	12.73	12.73	27.66	47.06

Detailed model parameters for the scenarios are included in Appendix B.

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2.10.5 Nearby Source Inventory

A nearby source inventory within approximately 20 km of the facility was provided by the CDPHE for use in the cumulative NAAQS impact assessments. It was determined by the CDPHE[13] that nearby sources of NO_X, CO, and $PM_{2.5}$ must be included in cumulative modeling analyses performed for these pollutants. The inventory contains all nearby NO_X, CO, and $PM_{2.5}$ sources that met or exceeded a ratio of emissions (Q) to distance (D) of 10, with Q in tons per year and distance in kilometers between the nearby source and the Facility. All emission units contained in the nearby source inventory provided by the CDPHE were included in the appropriate cumulative analyses.

The following Colorado Interstate Gas Co. – Watkins C.S (Facility AIRS ID 001-0036) sources provided in the nearby source inventory were modeled with an ISR of 0.3, consistent with the EPA's ISR database[14] for analogous Cooper-Bessmer engines that are 2-stroke lean burn and fire natural gas:

- AIRS ID 001-0036-001 - 4/2700HP COOPER BESSEMER
- AIRS ID 001-0036-002 - 5/2700HP COOPER BESSEMER

All other nearby sources were modeled with an ISR of 0.5, consistent with Colorado modeling guidelines.

[13] A copy of this determination is provided in Appendix A.

[14] Filtered available entries in Excel file "NO_2_ISR_database.xlsx", EPA NO_2/NO_X in-stack ratio database, available at https://www.epa.gov/scram/nitrogen-dioxidenitrogen-oxide-stack-ratio-isr-database, accessed September 9, 2025. The average ISR for analogous Cooper-Bessmer engines is 0.28.

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3. MODELING RESULTS

Based on the modeling methodology above, it has been determined that the DEN-22 facility does not cause or contribute 1-hour NO_2, 1-hour CO, 8-hour CO, and 24-hour $PM_{2.5}$ NAAQS violations. The sections below detail the results of the significant impact and cumulative impact analyses. Electronic modeling files are provided in Appendix C.

Per the discussion in Section 2.10.3, Amazon has included results from four (4) operating scenarios.

3.1 Significant Impact Analysis – NO_2

All 1-hour NO_2 scenarios were conservatively determined to exceed the SIL, therefore, a NAAQS analysis was conducted in lieu of a SIL analysis. Please see Section 3.4 for the full NAAQS analysis.

3.2 Significant Impact Analysis – CO

Table 3-1 below indicates the maximum ground level concentration (GLC_{max}) results of the Class II SIL analysis for CO.

Table 3-1. CO SIL Results

Pollutant	Averaging Period [a]	Operating Scenario [b]	GLC_{max} (µg/m³)	SIL (µg/m³)	> SIL?
CO	1-hr	CT	91.97	2,000	No
		PM	122.87		
		LB	76.40		
		LLT	45.10		
	8-hr	CT	90.30	500	No
		PM	171.85		
		LB	95.97		
		LLT	68.19		

[a] The modeled impact is the highest-1st-high modeled concentration.

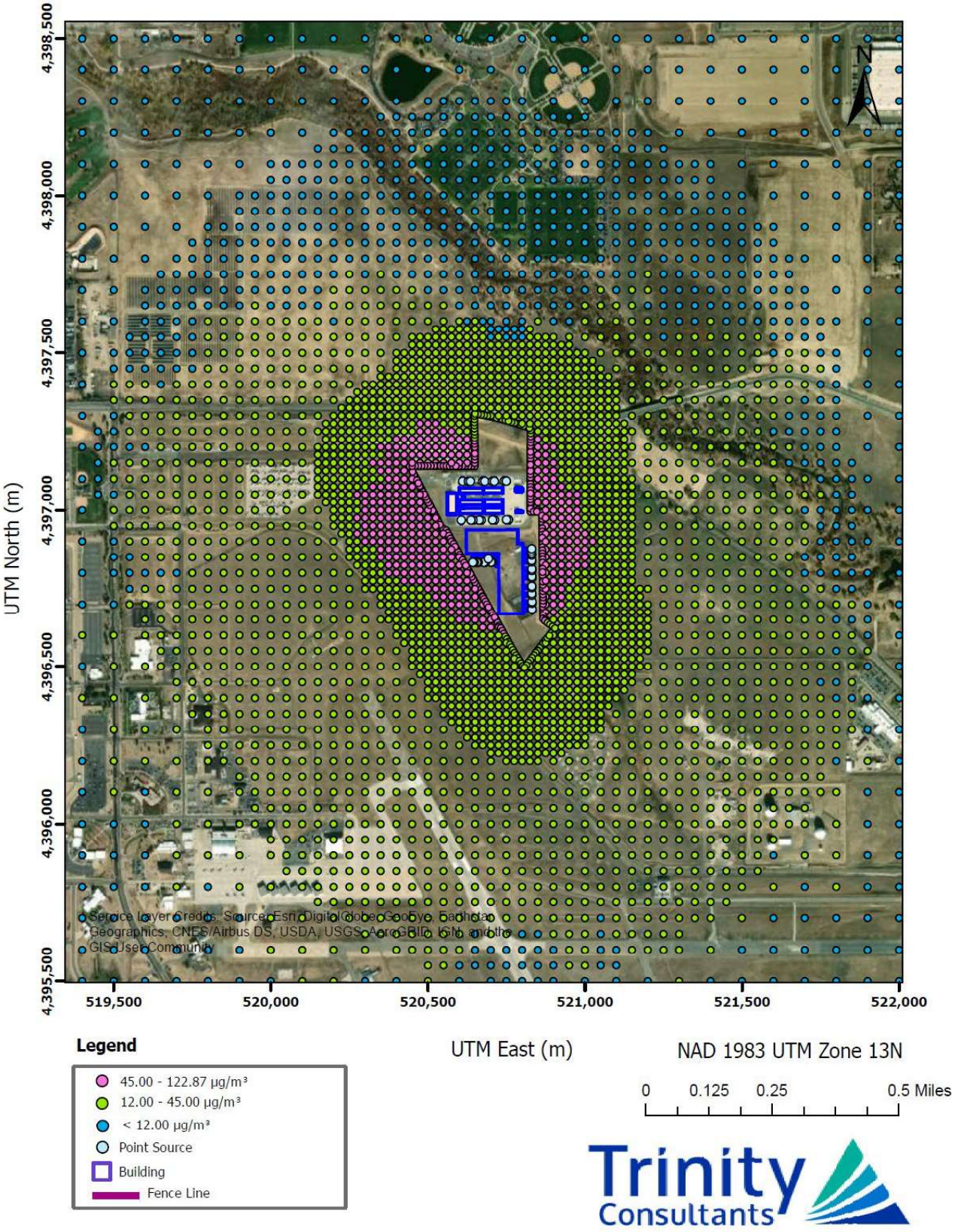
[b] Each operating scenario varies in modeling parameters such as temperature, velocity, and emission rate.

As shown in Table 3-1, the maximum predicted concentrations for all considered scenarios show impacts that do not exceed the applicable 1-hour CO SIL of 2,000 µg/m³ and the 8-hour CO SIL of 500 µg/m³. Therefore, further NAAQS analysis is not required for 1-hour and 8-hour CO.

Figure 3-1 and Figure 3-2 below show the concentration gradient of the CO SIL analyses. Note that only the scenario with the highest maximum predicted concentrations were shown.

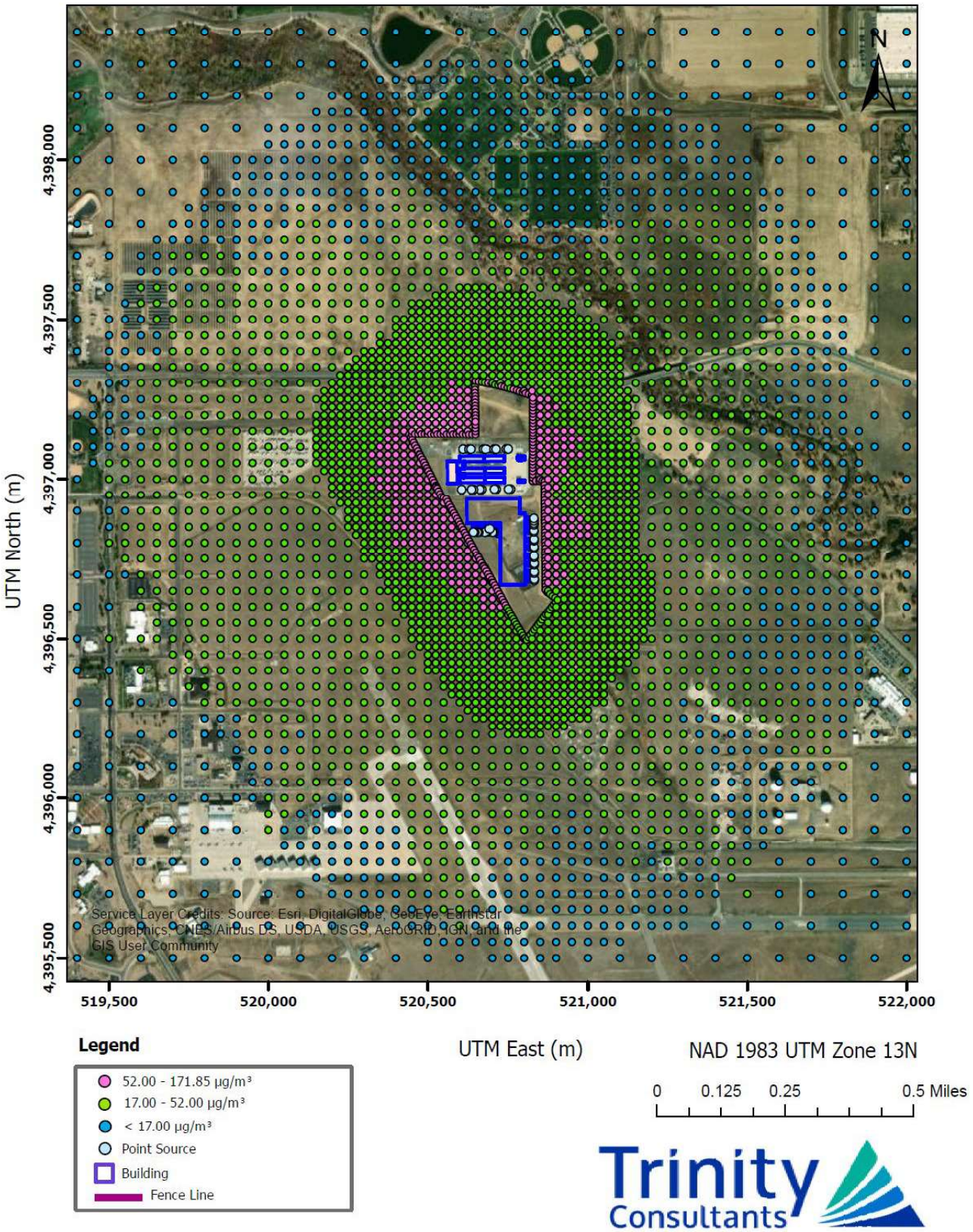
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Figure 3-1. 1-Hour CO SIL Results (Preventative Maintenance Test Scenario)



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Figure 3-2. 8-Hour CO SIL Results (Preventative Maintenance Test Scenario)



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3.3 Significant Impact Analysis – $PM_{2.5}$

Table 3-2 below indicates the GLC_{max} results of the Class II SIL analysis for $PM_{2.5}$.

Table 3-2. $PM_{2.5}$ SIL Results

Pollutant	Averaging Period	Operating Scenario [b]	GLC_{max} (µg/m³)	SIL (µg/m³)	> SIL?
$PM_{2.5}$	24-hour [a]	CT	0.10	1.2	No
		PM	0.23		
		LB	0.22		
		LLT	0.12		

[a] The modeled impact is the highest-1st-high modeled concentration.

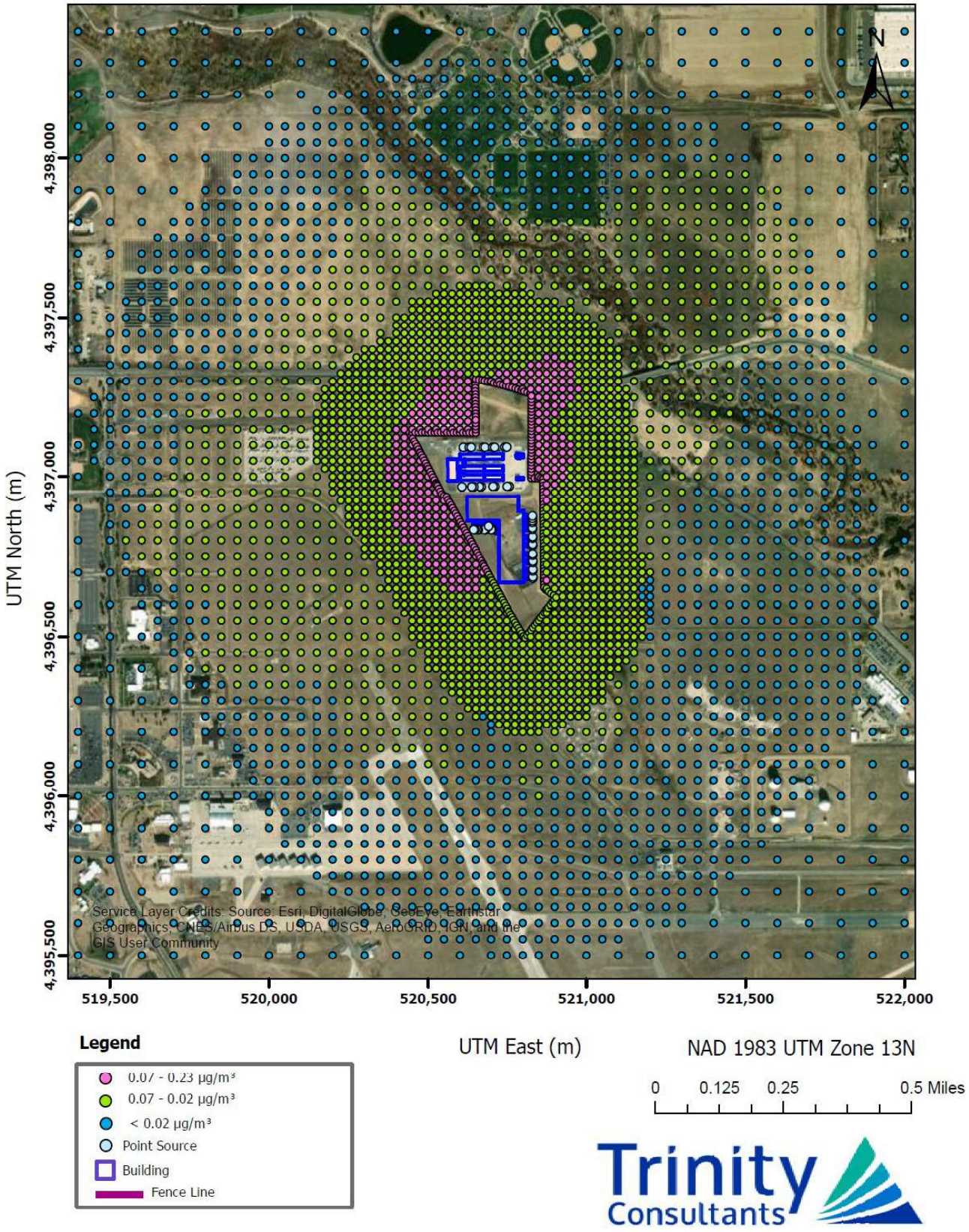
[b] Each operating scenario varies in modeling parameters such as temperature, velocity, and emission rate.

As shown in Table 3-2, the maximum predicted concentrations for all considered scenarios show impacts that do not exceed the applicable 24-hour $PM_{2.5}$ SIL of 1.2 µg/m³. Therefore, further NAAQS analysis is not required for 24-hour $PM_{2.5}$.

Figure 3-3 below shows the concentration gradient of the $PM_{2.5}$ 24-hour SIL analysis. Note that only the scenario with the highest maximum predicted concentrations was shown.

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Figure 3-3. 24-Hour $PM_{2.5}$ SIL Results (Preventative Maintenance Test Scenario)



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3.4 NAAQS Analysis – NO_2

A cumulative NAAQS analysis is required when a facility's impacts are over SILs. Amazon has conservatively assumed that all scenarios for 1-hr NO_2 were above SIL, so a NAAQS analysis was done in lieu of an initial SIL analysis. A cumulative analysis includes the facility, nearby sources (as necessary), and an ambient background concentration compared to the CAAQS and NAAQS, as applicable for each pollutant. Note that the full receptor grid was utilized for this analysis.

Table 3-3 below shows the results of the NAAQS analysis for 1-hr NO_2. As discussed in Section 2.10.5, the CDPHE indicated nearby sources are required to be included in the cumulative impacts assessment for NO_2. As such, the NO_2 cumulative impacts represented in Table 3-3 below, represent the impacts from the Facility, nearby sources, and the provided background concentration.

Table 3-3. NO_2 NAAQS Results

Pollutant	Averaging Period	Modeled Output	Operating Scenario	Total Impacts [a] (µg/m³)	CAAQS/NAAQS (µg/m³)	Total Impact > NAAQS?
NO_2 [a]	1-hour [b]	H8H	CT	163.71	188	No
			PM	163.71		
			LB	163.71		
			LLT	164.39		

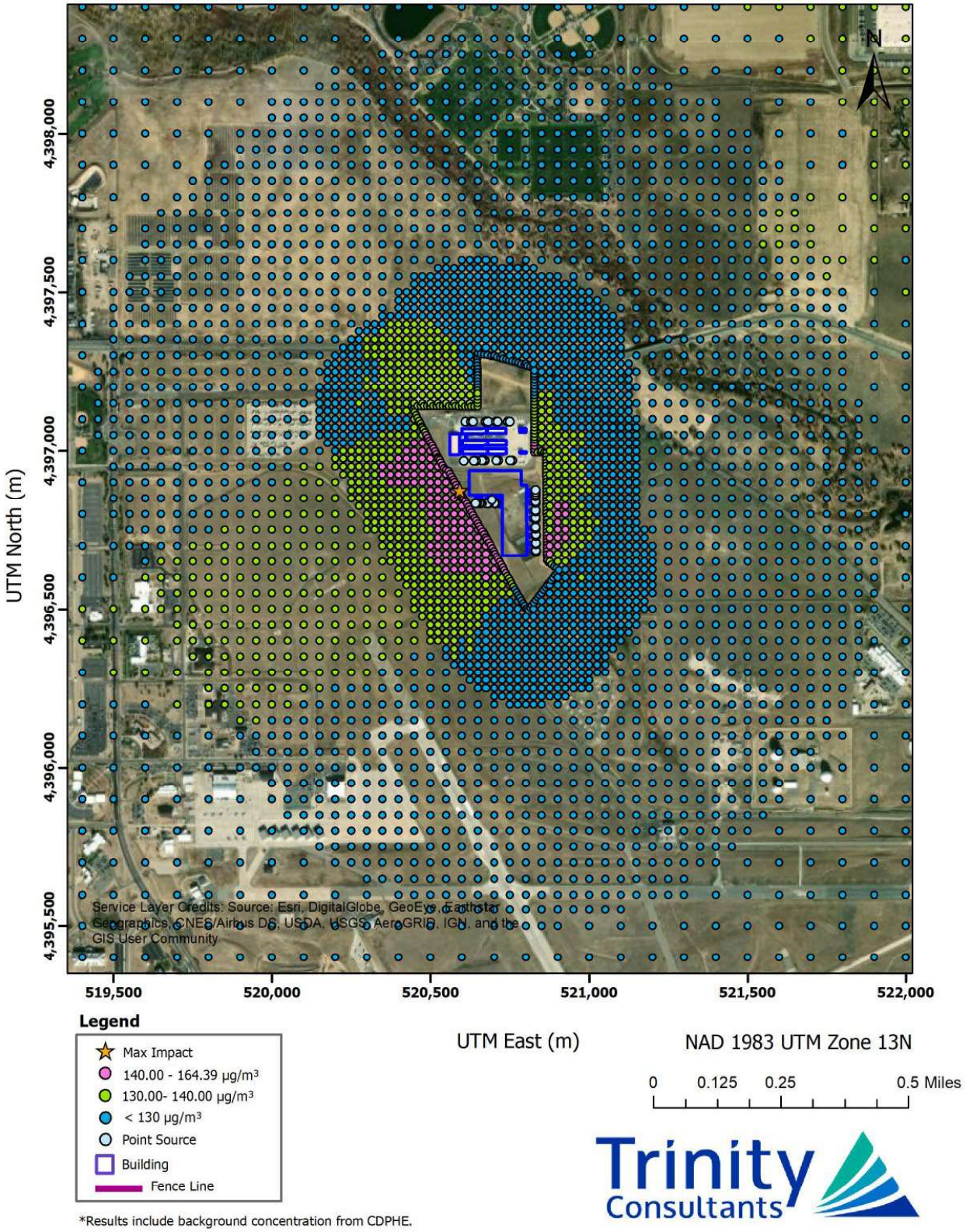
[a] The total modeled impact is inclusive of seasonal background.

As shown in the above table, the maximum predicted concentrations at all receptors are below the applicable CAAQS and NAAQS for NO_2 for all facility operating scenarios. Therefore, compliance with the CAAQS and NAAQS requirement is demonstrated.

Figure 3-4 below shows the concentration gradient of the NO_2 1-hour cumulative analysis. Note that only the scenario with the highest maximum predicted concentrations was shown.

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Figure 3-4. 1-Hour NO_2 NAAQS Results (Annual Live Load Transfer Test Scenario)



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APPENDIX A. SUPPORTING DOCUMENTS

Meteorological Data Correspondence
Background Concentrations Correspondence
Nearby Sources Correspondence

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Veronica Lui

From: kimberly.tarde@state.co.us on behalf of APCD Modeling Files - CDPHE , CDPHE <cdphe_apcd_modeling_files@state.co.us>
Sent: Monday, September 22, 2025 11:50 AM
To: Hanna Warlick
Cc: Veronica Lui; Glazer, Dan
Subject: Re: Modeling Data Request - Amazon Data Services, Inc.
Attachments: DIA_17-21_v24142.zip; Arapahoe_Amazon-DEN22 Pad 1 & 2_ABCLetter_Sept 2025.pdf; LaCasa-2022-2024-Seasonal_Hourly_NO2_Background_Concentration_Profile.pdf; LaCasa-2022-2024-Seasonal_Hourly_O3_Background_Concentration_Profile.pdf; Amazon Data Services DEN-22 Pad 1 & 2 Nearby Sources.xlsx

Hanna,

Please see below and attached for the meteorological data, background data, and nearby source inventory for this facility. Please note that we are still processing the hourly NO2 and O3 data for use with GRSM and will provide these files later this week.

Meteorological determination

Please see attached meteorological data processed with AERMET version 24142, both with and without ADJ_U*.

The Division has completed the AERMOD meteorological determination for: **Amazon Data Services, Inc. - DEN22 Pad 1 & 2**
Approximate Location: 39.72109, -104.75728 (Lat/Long)

The Division has determined that surface meteorology from Denver International Airport (DIA) data processed with Denver upper air is adequately representative of dispersion conditions at the site.

SURFACE METEOROLOGY
Met Site: DIA
Tower LAT/LONG: 39.867N, 104.667W
Tower type: ASOS
Data type: 1-min-site-specific
Profile Base Elevation: 1656 ft
Data period: 2017-2021
Data availability: attached

UPPER AIR METEOROLOGY
Site: KDEN (Denver, CO)
WBAN number: 23062
Data type: Radiosonde
Site LAT/LONG: 39.77N, 104.88W
Collected by: National Weather Service (NWS)
Data format: NOAA Forecast Systems Laboratory (fsl) format
Data availability: attached

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Ambient Background Concentration Determination

Per your request, attached is the ambient background concentration letter for NO2, O3, and PM2.5 and seasonal hourly profiles for NO2 and O3. We are currently processing NO2 and O3 hourly data for use with GRSM and will send you these files later this week.

Nearby Source Inventory

The Dispersion Modeling Unit (DMU) has reviewed the extraction of nearby sources that you requested and selected which sources need to be modeled in addition to the background if you need to demonstrate compliance through a cumulative model run for the requested pollutant. **Please use the provided model IDs** as this will help expedite the review process for your application. After review, it was determined that five (5) nearby sources of CO (005_1291:WASTE MANAGEMENT - DENVER ARAPAHOE DISPO, 001_0003:SUNCOR ENERGY - DENVER REFINERY, 001_0025:WES DJ GAS PROC - WATTENBERG PLANT, 001_0106:UNIV OF COLO - ANSCHUTZ MEDICAL CAMPUS, and 001_0036:COLORADO INTERSTATE GAS CO - WATKINS C.S), six (6) nearby sources of NO2 (001_0036:COLORADO INTERSTATE GAS CO - WATKINS C.S, 005_0028:NRO - AEROSPACE DATA FACIITY (ADF-C), 001_0003:SUNCOR ENERGY - DENVER REFINERY, 001_0025:WES DJ GAS PROC - WATTENBERG PLANT, 005_1291:WASTE MANAGEMENT - DENVER ARAPAHOE DISPO, and 001_1354:PUBLIC SERV - BLUE SPRUCE ENERGY CENTER), and one (1) nearby source of PM2.5 (005_1291:WASTE MANAGEMENT - DENVER ARAPAHOE DISPO) must be included in the cumulative modeling analysis.

DMU performed an initial screening by evaluating the ratio between the annual emissions (Q) from each nearby facility and the distance (D) from the nearby facility. Nearby facilities with a Q/D ratio less than 10 for the specific pollutant are generally assumed not to have a significant impact within the impact area of your source based on modeling of a theoretical source with conservative dispersion characteristics. Nearby facilities above this threshold were further evaluated based on facility emissions, expected wind direction, and proximity to both the project site and background monitor. PMU believes that the inclusion of the identified nearby source, in addition to the ambient background, will be conservative given the background monitor selected. Please keep in mind that we assume 8760 hours of operation for all nearby sources in our review of cumulative modeling.

This determination is not applicable for an unlimited period and may expire if there is a substantial delay between the date of this determination and the submittal of the permit application. If the location of the source moves or if additional modeling is warranted in the future at this site, contact the Division to confirm if this met determination is still valid. This determination is applicable provided that the permit application is not subject to the PSD rules. If the permitting action is subject to PSD rules, please contact the Division for a PSD pre-construction monitoring determination.

The completeness checklist for modeling submittals is available here: https://drive.google.com/file/d/1XoSn1QSPBnpDGHh0Ojib7l-sGAN074bh/view?usp=sharing.

State law requires that the Division determine the completeness of an application or any supplemental information requested for the application by the Division within 60 days of receipt. If

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the application (this includes the modeling submittal) is deemed incomplete, the applicant will be notified regarding the deficiencies and asked to either supplement the application or submit a new complete application. **It is important to note that our review will not begin until a complete application has been received.**

Please let us know if you have any questions.

Regards,

Modeling Files Request
Dispersion Modeling Unit
Stationary Sources Program
O 720.235.8143
4300 Cherry Creek Drive South, Denver, CO 80246-1530
https://cdphe.colorado.gov/air-emissions/air-quality-modeling-guidance-for-permits

Learn more about COVID19 https://www.colorado.gov/pacific/cdphe/apcd-covid-19 .

Are you curious about ground-level ozone in Colorado? Visit our ozone webpage to learn more.

Any correspondence with this Email address is subject to the Colorado Open Records Act and may be disclosed to third parties.

On Thu, Sep 18, 2025 at 3:20 PM APCD Modeling Files - CDPHE , CDPHE <cdphe_apcd_modeling_files@state.co.us> wrote:

> Hello Hanna,
>
> Thank you for reaching out. Your data request is under active review and is expected to be sent out by early next week. I do not need any additional information at this time.
>
> Thank you,
>
> **Modeling Files Request**
> **Dispersion Modeling Unit**
> Stationary Sources Program
> O 720.235.8143
> 4300 Cherry Creek Drive South, Denver, CO 80246-1530
> https://cdphe.colorado.gov/air-emissions/air-quality-modeling-guidance-for-permits
>
> Learn more about COVID19 https://www.colorado.gov/pacific/cdphe/apcd-covid-19 .
>
> Are you curious about ground-level ozone in Colorado? Visit our ozone webpage to learn more.
>
> **Any correspondence with this Email address is subject to the Colorado Open Records Act and may be disclosed to third parties.**

On Wed, Sep 17, 2025 at 3:46 PM Hanna Warlick <HWarlick@trinityconsultants.com> wrote:

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Hi Dave and Modeling Team,

I just wanted to follow up on the requested data and confirm if any additional information is needed to finish processing the below request?

Thanks,

Hanna Warlick

Managing Consultant

M 678.852.9710

Book time to meet with me

From: Thayer - CDPHE He Him, David <david.thayer@state.co.us>
Sent: Friday, September 5, 2025 4:32 PM
To: Veronica Lui <Veronica.Lui@trinityconsultants.com>
Cc: APCD Modeling Files - CDPHE , CDPHE <cdphe_apcd_modeling_files@state.co.us>; Hanna Warlick <HWarlick@trinityconsultants.com>; Glazer, Dan <deglazer@amazon.com>
Subject: Re: Modeling Data Request - Amazon Data Services, Inc.

I've completed the nearby source extraction(s) and preliminary QA for your request. The data will be sent to the Division's modeling group for review. Upon review they will contact you with further information.

If you have any questions regarding these data please feel free to contact me.

--
Dave Thayer
Colorado Department of Public Health and Environment
Air Pollution Control Division / Stationary Sources Program
david.thayer@state.co.us, Voice:303-692-3187, FAX:303-782-0278

Any correspondence with this Email address is subject to the
Colorado Open Records Act and may be disclosed to third parties.

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On Fri, Sep 5, 2025 at 1:59 PM Veronica Lui <Veronica.Lui@trinityconsultants.com> wrote:

Hi CDPHE Modeling Team,

To clarify, we are interested in using GRSM and would like to specifically request hourly NOx and ozone data for use in GRSM if possible.

See the attached updated background concentration request form to include ozone data.

Please let us know if you have any questions!

Thanks,

Veronica Lui (she/her)

Consultant

**Upcoming Out-of-Office: Sept 13 – Sept 21

M 720.217.8538

Email: veronica.lui@trinityconsultants.com

1999 Broadway, Suite 820 | Denver, Colorado 80202

From: Veronica Lui
Sent: Friday, September 5, 2025 12:18 PM
To: APCD Modeling Files - CDPHE , CDPHE <cdphe_apcd_modeling_files@state.co.us>; Thayer - CDPHE He Him, David <david.thayer@state.co.us>
Cc: Hanna Warlick <HWarlick@trinityconsultants.com>; Glazer, Dan <deglazer@amazon.com>
Subject: Modeling Data Request - Amazon Data Services, Inc.

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Hi CDPHE Modeling Team,

Trinity would like to request the meteorological data, background concentration data, and nearby source data for a data center located in Arapahoe County, Colorado.

Attached are the background concentration request form and an aerial map identifying the source location. Additional information is provided below to support the meteorological and nearby source data request. Please note that seasonal hourly data is needed for background concentrations.

Facility Information:

- Company/Proposed Facility: Amazon Data Services, Inc., DEN-22 Pad 1 & 2 Facility
- Source Location: 39.721087°,-104.757278°
- Pollutants for Background Concentration and Inventory: NO_2, CO, and $PM_{2.5}$ per APCD Form 114 and NO_x for potential Tier III NO/NO_2 GRSM Processing
- Source Type: Generator engines
- Stack Types: Point sources

Source Boundary: If it is determined that nearby sources must be explicitly included in the model (vs being accounted for in the background concentration), Trinity requests data to an extent boundary of 20 km from the facility, to be conservative.

Please let us know if you have any questions regarding:

- Meteorological Determination and Data
- Background Concentration Data
- Nearby Source Inventory Evaluation and Data (if applicable).

Thanks,

Veronica Lui (she/her)

Consultant

**Upcoming Out-of-Office: Sept 13 – Sept 21

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M 720.217.8538

Email: veronica.lui@trinityconsultants.com

1999 Broadway, Suite 820 | Denver, Colorado 80202

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COLORADO
Air Pollution Control Division
Department of Public Health & Environment

Hanna Warlick
By email: <HWarlick@trinityconsultants.com>

September 22, 2025

Request Information

Facility: DEN22 Pad 1 & 2
Company: Amazon Data Services, Inc.
County: Arapahoe
Latitude (NAD83): 39.721087
Longitude (NAD83): -104.757278

Requested Pollutants

Pollutant: CO, 1-hr (2nd Maximum)
Air Quality Standard: 35 ppm
Background: 1.8 ppm
Basis: La Casa, 2022 – 2023

Pollutant: CO, 8-hr (2nd Maximum)
Air Quality Standard: 9 ppm
Background: 1.4 ppm
Basis: La Casa, 2022 – 2023

Pollutant: O3, 8-hr (4th Maximum)
Air Quality Standard: 0.070 ppm
Background: 0.075 ppm
Basis: La Casa, 2022 - 2024

Pollutant: NO2, 1-hr (98th percentile of maximum daily 1-hr values)
Air Quality Standard: 100 ppb
Background: 53 ppb
Basis: La Casa, 2022 - 2024

Pollutant: NO2, Annual Mean
Air Quality Standard: 53 ppb
Background: 15 ppb
Basis: La Casa, 2022 - 2024

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Pollutant: PM2.5, 24-hr (98th percentile)
Air Quality Standard: 35 µg/m^3
Background: 14.6 µg/m^3
Basis: La Casa, 2022 – 2024 (smoke adjusted)

Pollutant: PM2.5, annual mean
Air Quality Standard: 9.0 µg/m^3
Background: 5.5 µg/m^3
Basis: La Casa, 2022 - 2024 (smoke adjusted)

Not Requested Pollutants

Sulfur Dioxide (SO2)

Nitrogen Dioxide (NO2)

Particulate Matter, diameter smaller than 2.5 micron (PM2.5)

Upon request, refinement of a single value background concentration listed above may be conducted by the modeling staff (email: cdphe_apcd_modeling_files@state.co.us), if applicable, appropriate, and justified.

These estimates are derived from ambient monitored concentrations that are available to the Division to represent background levels (added to the impacts of the project emissions and emissions from other nearby sources) in cumulative ambient air impacts for comparison to the NAAQS. They are not suitable for applications beyond that scope of use. The quantity of data is sometimes limited and may be of uncertain quality. The ambient background concentrations -

1. Do not necessarily substitute for on-site monitoring data; i.e., for permitting actions subject to PSD rules, pre-construction monitoring may be required.
2. Indicate the ambient levels in general geographic areas, not a specific location. This is particularly true for particulate concentration values.
3. Are subject to change without notice as new information is acquired.

Use of these background estimates should be accompanied by an appropriate citation that indicates their source and their limitations. Referencing this letter would be adequate, but an expanded explanation is suggested.

If you have questions, I can be reached at 720-235-8143, or email: cdphe_apcd_modeling_files@state.co.us.

Sincerely,

Permit Modeling Unit

Air Pollution Control Division

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Veronica Lui

From: kimberly.tarde@state.co.us on behalf of APCD Modeling Files - CDPHE , CDPHE <cdphe_apcd_modeling_files@state.co.us>
Sent: Monday, September 29, 2025 4:51 PM
To: Hanna Warlick
Cc: Veronica Lui; Glazer, Dan
Subject: Re: Modeling Data Request - Amazon Data Services, Inc.
Attachments: La Casa O3 Subs_2017-2021.txt; La Casa NOx Subs_2017-2021.txt; 2017-2021 _LaCasa_O3.txt; 2017-2021_LaCasa_NOx.txt

Hanna,

Please see the attached hourly NOx and O3 files for the La Casa station.

Regards,

Modeling Files Request
Dispersion Modeling Unit
Stationary Sources Program
O 720.235.8143
4300 Cherry Creek Drive South, Denver, CO 80246-1530
https://cdphe.colorado.gov/air-emissions/air-quality-modeling-guidance-for-permits

Learn more about COVID19 https://www.colorado.gov/pacific/cdphe/apcd-covid-19 .

Are you curious about ground-level ozone in Colorado? Visit our ozone webpage to learn more.

Any correspondence with this Email address is subject to the Colorado Open Records Act and may be disclosed to third parties.

On Mon, Sep 29, 2025 at 8:55 AM Hanna Warlick <HWarlick@trinityconsultants.com> wrote:

> Hello,
>
> Thank you for these files. Can you please also provide the hourly NO2 and O3 data for use with GRSM?
>
> Thanks,
>
> **Hanna Warlick**
>
> Managing Consultant

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M 678.852.9710

Book time to meet with me

From: kimberly.tarde@state.co.us <kimberly.tarde@state.co.us> **On Behalf Of** APCD Modeling Files - CDPHE , CDPHE
Sent: Monday, September 22, 2025 11:50 AM
To: Hanna Warlick <HWarlick@trinityconsultants.com>
Cc: Veronica Lui <Veronica.Lui@trinityconsultants.com>; Glazer, Dan <deglazer@amazon.com>
Subject: Re: Modeling Data Request - Amazon Data Services, Inc.

Hanna,

Please see below and attached for the meteorological data, background data, and nearby source inventory for this facility. Please note that we are still processing the hourly NO2 and O3 data for use with GRSM and will provide these files later this week.

Meteorological determination

Please see attached meteorological data processed with AERMET version 24142, both with and without ADJ_U*.

The Division has completed the AERMOD meteorological determination for: **Amazon Data Services, Inc. - DEN22 Pad 1 & 2**
Approximate Location: 39.72109, -104.75728 (Lat/Long)

The Division has determined that surface meteorology from Denver International Airport (DIA) data processed with Denver upper air is adequately representative of dispersion conditions at the site.

SURFACE METEOROLOGY
Met Site: DIA
Tower LAT/LONG: 39.867N, 104.667W
Tower type: ASOS
Data type: 1-min-site-specific
Profile Base Elevation: 1656 ft
Data period: 2017-2021
Data availability: attached

UPPER AIR METEOROLOGY
Site: KDEN (Denver, CO)
WBAN number: 23062
Data type: Radiosonde
Site LAT/LONG: 39.77N, 104.88W

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Collected by: National Weather Service (NWS)
Data format: NOAA Forecast Systems Laboratory (fsl) format
Data availability: attached

Ambient Background Concentration Determination

Per your request, attached is the ambient background concentration letter for NO2, O3, and PM2.5 and seasonal hourly profiles for NO2 and O3. We are currently processing NO2 and O3 hourly data for use with GRSM and will send you these files later this week.

Nearby Source Inventory

The Dispersion Modeling Unit (DMU) has reviewed the extraction of nearby sources that you requested and selected which sources need to be modeled in addition to the background if you need to demonstrate compliance through a cumulative model run for the requested pollutant. **Please use the provided model IDs** as this will help expedite the review process for your application. After review, it was determined that five (5) nearby sources of CO (005_1291:WASTE MANAGEMENT - DENVER ARAPAHOE DISPO, 001_0003:SUNCOR ENERGY - DENVER REFINERY, 001_0025:WES DJ GAS PROC - WATTENBERG PLANT, 001_0106:UNIV OF COLO - ANSCHUTZ MEDICAL CAMPUS, and 001_0036:COLORADO INTERSTATE GAS CO - WATKINS C.S), six (6) nearby sources of NO2 (001_0036:COLORADO INTERSTATE GAS CO - WATKINS C.S, 005_0028:NRO - AEROSPACE DATA FACIITY (ADF-C), 001_0003:SUNCOR ENERGY - DENVER REFINERY, 001_0025:WES DJ GAS PROC - WATTENBERG PLANT, 005_1291:WASTE MANAGEMENT - DENVER ARAPAHOE DISPO, and 001_1354:PUBLIC SERV - BLUE SPRUCE ENERGY CENTER), and one (1) nearby source of PM2.5 (005_1291:WASTE MANAGEMENT - DENVER ARAPAHOE DISPO) must be included in the cumulative modeling analysis.

DMU performed an initial screening by evaluating the ratio between the annual emissions (Q) from each nearby facility and the distance (D) from the nearby facility. Nearby facilities with a Q/D ratio less than 10 for the specific pollutant are generally assumed not to have a significant impact within the impact area of your source based on modeling of a theoretical source with conservative dispersion characteristics. Nearby facilities above this threshold were further evaluated based on facility emissions, expected wind direction, and proximity to both the project site and background monitor. PMU believes that the inclusion of the identified nearby source, in addition to the ambient background, will be conservative given the background monitor selected. Please keep in mind that we assume 8760 hours of operation for all nearby sources in our review of cumulative modeling.

This determination is not applicable for an unlimited period and may expire if there is a substantial delay between the date of this determination and the submittal of the permit application. If the location of the source moves or if additional modeling is warranted in the future at this site, contact the Division to confirm if this met determination is still valid. This

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determination is applicable provided that the permit application is not subject to the PSD rules. If the permitting action is subject to PSD rules, please contact the Division for a PSD pre-construction monitoring determination.

The completeness checklist for modeling submittals is available here: https://drive.google.com/file/d/1XoSn1QSPBnpDGHh0Ojib7l-sGAN074bh/view?usp=sharing.

State law requires that the Division determine the completeness of an application or any supplemental information requested for the application by the Division within 60 days of receipt. If the application (this includes the modeling submittal) is deemed incomplete, the applicant will be notified regarding the deficiencies and asked to either supplement the application or submit a new complete application. **It is important to note that our review will not begin until a complete application has been received.**

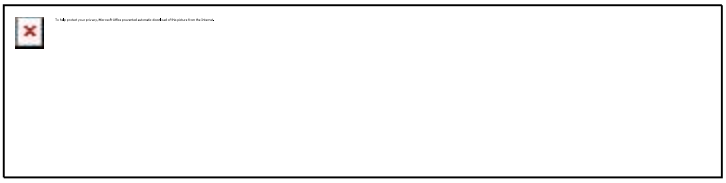
Please let us know if you have any questions.

Regards,

Modeling Files Request

Dispersion Modeling Unit

Stationary Sources Program



O 720.235.8143

4300 Cherry Creek Drive South, Denver, CO 80246-1530

https://cdphe.colorado.gov/air-emissions/air-quality-modeling-guidance-for-permits

Learn more about COVID19 https://www.colorado.gov/pacific/cdphe/apcd-covid-19 .

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On Thu, Sep 18, 2025 at 3:20 PM APCD Modeling Files - CDPHE , CDPHE <cdphe_apcd_modeling_files@state.co.us> wrote:

Hello Hanna,

Thank you for reaching out. Your data request is under active review and is expected to be sent out by early next week. I do not need any additional information at this time.

Thank you,

Modeling Files Request

Dispersion Modeling Unit

Stationary Sources Program

O 720.235.8143

4300 Cherry Creek Drive South, Denver, CO 80246-1530

https://cdphe.colorado.gov/air-emissions/air-quality-modeling-guidance-for-permits

Learn more about COVID19 https://www.colorado.gov/pacific/cdphe/apcd-covid-19 .

Are you curious about ground-level ozone in Colorado? Visit our ozone webpage to learn more.

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Any correspondence with this Email address is subject to the Colorado Open Records Act and may be disclosed to third parties.

On Wed, Sep 17, 2025 at 3:46 PM Hanna Warlick <HWarlick@trinityconsultants.com> wrote:

Hi Dave and Modeling Team,

I just wanted to follow up on the requested data and confirm if any additional information is needed to finish processing the below request?

Thanks,

Hanna Warlick

Managing Consultant

M 678.852.9710

Book time to meet with me

From: Thayer - CDPHE He Him, David <david.thayer@state.co.us>
Sent: Friday, September 5, 2025 4:32 PM
To: Veronica Lui <Veronica.Lui@trinityconsultants.com>
Cc: APCD Modeling Files - CDPHE , CDPHE <cdphe_apcd_modeling_files@state.co.us>; Hanna Warlick <HWarlick@trinityconsultants.com>; Glazer, Dan <deglazer@amazon.com>
Subject: Re: Modeling Data Request - Amazon Data Services, Inc.

I've completed the nearby source extraction(s) and preliminary QA for your request. The data will be sent to the Division's modeling group for review. Upon review they will contact you with further information.

If you have any questions regarding these data please feel free to contact me.

--
Dave Thayer

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Colorado Department of Public Health and Environment
Air Pollution Control Division / Stationary Sources Program
david.thayer@state.co.us, Voice:303-692-3187, FAX:303-782-0278

Any correspondence with this Email address is subject to the
Colorado Open Records Act and may be disclosed to third parties.

On Fri, Sep 5, 2025 at 1:59 PM Veronica Lui <Veronica.Lui@trinityconsultants.com> wrote:

> Hi CDPHE Modeling Team,
>
> To clarify, we are interested in using GRSM and would like to specifically request hourly NOx and ozone data for use in GRSM if possible.
>
> See the attached updated background concentration request form to include ozone data.
>
> Please let us know if you have any questions!
>
> Thanks,
>
> **Veronica Lui** (she/her)
>
> Consultant
>
> **Upcoming Out-of-Office: Sept 13 – Sept 21
>
> M 720.217.8538
>
> Email: veronica.lui@trinityconsultants.com
>
> 1999 Broadway, Suite 820 | Denver, Colorado 80202

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From: Veronica Lui
Sent: Friday, September 5, 2025 12:18 PM
To: APCD Modeling Files - CDPHE , CDPHE <cdphe_apcd_modeling_files@state.co.us>; Thayer - CDPHE He Him, David <david.thayer@state.co.us>
Cc: Hanna Warlick <HWarlick@trinityconsultants.com>; Glazer, Dan <deglazer@amazon.com>
Subject: Modeling Data Request - Amazon Data Services, Inc.

Hi CDPHE Modeling Team,

Trinity would like to request the meteorological data, background concentration data, and nearby source data for a data center located in Arapahoe County, Colorado.

Attached are the background concentration request form and an aerial map identifying the source location. Additional information is provided below to support the meteorological and nearby source data request. Please note that seasonal hourly data is needed for background concentrations.

Facility Information:

- Company/Proposed Facility: Amazon Data Services, Inc., DEN-22 Pad 1 & 2 Facility
- Source Location: 39.721087°,-104.757278°
- Pollutants for Background Concentration and Inventory: NO_2, CO, and $PM_{2.5}$ per APCD Form 114 and NO_x for potential Tier III NO/NO_2 GRSM Processing
- Source Type: Generator engines
- Stack Types: Point sources

Source Boundary: If it is determined that nearby sources must be explicitly included in the model (vs being accounted for in the background concentration), Trinity requests data to an extent boundary of 20 km from the facility, to be conservative.

Please let us know if you have any questions regarding:

- Meteorological Determination and Data
- Background Concentration Data
- Nearby Source Inventory Evaluation and Data (if applicable).

Thanks,

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Veronica Lui (she/her)

Consultant

**Upcoming Out-of-Office: Sept 13 – Sept 21

M 720.217.8538

Email: veronica.lui@trinityconsultants.com

1999 Broadway, Suite 820 | Denver, Colorado 80202

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1-hr NO_2 Concentration – La Casa (ppb)				
	Winter	**Spring**	**Summer**	**Fall**
	January–February 2022; January–February 2023; January–February 2024; December 2022-2024	**March-May 2022; March-May 2023; March-May 2024**	**June-August 2022; June-August 2023; June-August 2024**	**September – November 2022; September – November 2023; September – November 2024**
Hour Beginning	**3rd[a] High (Multiyear average of the 98th percentile by season and hour of day)**			
0	47.4	34.3	18.4	37.1
1	46.1	31.9	18.1	36.6
2	45.4	34.9	17.9	36.3
3	43.1	36.2	17.1	36.7
4	44.7	38.6	20.8	36.4
5	45.5	40.3	28.4	36.9
6	48.1	40.7	28.6	38.4
7	47.3	36.4	29.5	39.3
8	47.9	31.2	25.5	38.6
9	47.6	24.8	23.6	37.0
10	40.6	19.4	19.2	32.2
11	41.6	16.8	13.4	29.4
12	36.7	14.5	11.1	27.8
13	43.1	12.6	9.5	25.0
14	43.2	12.4	11.5	26.1
15	42.2	14.9	13.0	31.3
16	52.5	15.1	12.7	41.0
17	54.2	25.1	13.8	46.7
18	52.3	31.1	17.4	46.7
19	52.1	36.4	24.4	45.5
20	50.7	33.4	25.1	44.7
21	50.3	36.5	27.3	43.2
22	50.7	36.8	27.3	43.2
23	49.5	34.6	23.0	39.3

** La Casa NO2 Profile 2022-2024

SO BACKGRND SEASHR 47.4 46.1 45.4 43.1 44.7 45.5 48.1 47.3 47.9 47.6 40.6 41.6 36.7 43.1 43.2 42.2 52.5 54.2 52.3 52.1 50.7 50.3 50.7 49.5

SO BACKGRND SEASHR 34.3 31.9 34.9 36.2 38.6 40.3 40.7 36.4 31.2 24.8 19.4 16.8 14.5 12.6 12.4 14.9 15.1 25.1 31.1 36.4 33.4 36.5 36.8 34.6

SO BACKGRND SEASHR 18.4 18.1 17.9 17.1 20.8 28.4 28.6 29.5 25.5 23.6 19.2 13.4 11.1 9.5 11.5 13 12.7 13.8 17.4 24.4 25.1 27.3 27.3 23

SO BACKGRND SEASHR 37.1 36.6 36.3 36.7 36.4 36.9 38.4 39.3 38.6 37 32.2 29.4 27.8 25 26.1 31.3 41 46.7 46.7 45.5 44.7 43.2 43.2 39.3

[a] The use of 3rd High to represent the 98th percentile is based on EPA's guidance in the 2011 NO2 memo and assumes each season-hour sample set is approximately of size 91. For those season-hours where the sample size for this monitor differed significantly from the assumed size of 90-92 records for a complete dataset, the 2nd High, 1st High, or maximum of bounding hour values was used for that season-hour to represent the 98th percentile rather than the 3rd High.

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1-hr O_3 Concentration – La Casa (ppb)				
	Winter	**Spring**	**Summer**	**Fall**
	January–February 2022; January–February 2023; January–February 2024; December 2022-2024	**March-May 2022; March-May 2023; March-May 2024**	**June-August 2022; June-August 2023; June-August 2024**	**September – November 2022; September – November 2023; September – November 2024**
Hour Beginning	**4th High Value by Season and hour of day**			
0	38.3	52.3	52.3	39.7
1	39.7	51.0	50.0	39.7
2	42.0	51.0	48.3	37.3
3	38.3	49.7	46.7	37.3
4	40.3	45.7	43.7	35.3
5	35.0	44.0	42.0	31.7
6	34.0	45.0	42.7	30.0
7	35.7	47.3	46.0	34.7
8	40.3	50.7	53.0	38.0
9	42.7	54.7	62.3	44.3
10	44.3	58.7	70.7	53.7
11	47.3	63.0	78.0	62.7
12	48.3	64.3	81.7	64.3
13	51.0	67.0	81.0	65.7
14	50.7	67.3	81.3	67.3
15	50.3	68.0	81.3	65.3
16	48.3	66.3	76.3	63.3
17	44.3	62.3	73.0	58.3
18	42.3	61.0	69.0	49.3
19	41.7	56.0	64.7	46.3
20	44.3	54.3	58.3	46.0
21	41.7	53.0	57.3	45.3
22	39.0	51.7	55.0	43.3
23	40.7	52.3	54.7	43.3

** La Casa O3 Profile 2022-2024

CO O3VALUES SEASHR 38.3 39.7 42 38.3 40.3 35 34 35.7 40.3 42.7 44.3 47.3 48.3 51 50.7 50.3 48.3 44.3 42.3 41.7 44.3 41.7 39 40.7

CO O3VALUES SEASHR 52.3 51 51 49.7 45.7 44 45 47.3 50.7 54.7 58.7 63 64.3 67 67.3 68 66.3 62.3 61 56 54.3 53 51.7 52.3

CO O3VALUES SEASHR 52.3 50 48.3 46.7 43.7 42 42.7 46 53 62.3 70.7 78 81.7 81 81.3 81.3 76.3 73 69 64.7 58.3 57.3 55 54.7

CO O3VALUES SEASHR 39.7 39.7 37.3 37.3 35.3 31.7 30 34.7 38 44.3 53.7 62.7 64.3 65.7 67.3 65.3 63.3 58.3 49.3 46.3 46 45.3 43.3 43.3

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APPENDIX B. MODELING PARAMETERS

Table B-1. Modeled Source Parameters (Confidence Test Scenario)

Gen Type	Source Type *SRCTP*	Source ID	UTM Easting (m)	UTM Northing (m)	Elevation (m)	Stack Height *HGT* (m)	Temperature *TMP_1* (K)	Velocity *EXH_1* (m/s)	Exhaust Diameter *DIA* (m)	NO_x 1-hr (g/s)	CO 1-hr (g/s)	CO 8-hr (g/s)	$PM_{2.5}$ 24-hr (g/s)
Type C	POINT	B060_005	520,749.53	4,397,092.83	1686.33	4.67	567.93	12.73	0.46	8.847E-01	5.828E-01	5.828E-01	1.804E-03
Type C	POINT	B061_005	520,757.09	4,396,969.49	1686.33	11.89	567.93	12.73	0.46	8.847E-01	5.828E-01	5.828E-01	1.804E-03
Type C	POINT	B062_005	520,750.79	4,396,969.48	1686.33	11.89	567.93	12.73	0.46	8.847E-01	5.828E-01	5.828E-01	1.804E-03
Type C	POINT	B060_CE2	520,606.25	4,396,967.96	1686.33	11.89	567.93	12.73	0.46	8.847E-01	5.828E-01	5.828E-01	1.804E-03
Type C	POINT	B062_001	520,637.39	4,396,968.23	1686.33	11.89	567.93	12.73	0.46	8.847E-01	5.828E-01	5.828E-01	1.804E-03
Type C	POINT	B061_001	520,643.69	4,396,968.24	1686.33	11.89	567.93	12.73	0.46	8.847E-01	5.828E-01	5.828E-01	1.804E-03
Type C	POINT	B061_002	520,663.27	4,396,968.49	1686.33	11.89	567.93	12.73	0.46	8.847E-01	5.828E-01	5.828E-01	1.804E-03
Type C	POINT	B062_002	520,669.58	4,396,968.50	1686.33	11.89	567.93	12.73	0.46	8.847E-01	5.828E-01	5.828E-01	1.804E-03
Type C	POINT	B062_003	520,706.29	4,396,969.10	1686.33	11.89	567.93	12.73	0.46	8.847E-01	5.828E-01	5.828E-01	1.804E-03
Type C	POINT	B062_004	520,712.59	4,396,969.11	1686.33	11.89	567.93	12.73	0.46	8.847E-01	5.828E-01	5.828E-01	1.804E-03
Type C	POINT	B060_004	520,743.23	4,397,092.82	1686.33	4.67	567.93	12.73	0.46	8.847E-01	5.828E-01	5.828E-01	1.804E-03
Type C	POINT	B061_004	520,711.70	4,397,092.25	1686.33	4.67	567.93	12.73	0.46	8.847E-01	5.828E-01	5.828E-01	1.804E-03
Type C	POINT	B061_003	520,705.40	4,397,092.24	1686.33	4.67	567.93	12.73	0.46	8.847E-01	5.828E-01	5.828E-01	1.804E-03
Type C	POINT	B060_003	520,681.15	4,397,092.30	1686.33	4.67	567.93	12.73	0.46	8.847E-01	5.828E-01	5.828E-01	1.804E-03
Type C	POINT	B060_002	520,674.85	4,397,092.30	1686.33	4.67	567.93	12.73	0.46	8.847E-01	5.828E-01	5.828E-01	1.804E-03
Type C	POINT	B060_001	520,635.62	4,397,092.17	1686.33	4.67	567.93	12.73	0.46	8.847E-01	5.828E-01	5.828E-01	1.804E-03
Type C	POINT	B060_DE1	520,629.31	4,397,092.17	1686.33	4.67	567.93	12.73	0.46	8.847E-01	5.828E-01	5.828E-01	1.804E-03
Type C	POINT	B060_CE1	520,610.71	4,397,092.30	1686.33	4.67	567.93	12.73	0.46	8.847E-01	5.828E-01	5.828E-01	1.804E-03
Type B	POINT	B064_HSG	520,692.87	4,396,844.20	1686.69	13.41	562.48	21.28	0.36	8.147E-01	4.983E-01	4.983E-01	2.497E-03
Type A	POINT	B064_04A	520,831.92	4,396,681.26	1686.69	13.41	608.93	9.29	0.61	1.294E+00	5.211E-01	5.211E-01	4.823E-04
Type A	POINT	B064_04B	520,831.92	4,396,685.85	1686.69	13.41	608.93	9.29	0.61	1.294E+00	5.211E-01	5.211E-01	4.823E-04
Type A	POINT	B064_03A	520,831.76	4,396,704.38	1686.69	13.41	608.93	9.29	0.61	1.294E+00	5.211E-01	5.211E-01	4.823E-04
Type A	POINT	B064_03B	520,831.75	4,396,708.98	1686.69	13.41	608.93	9.29	0.61	1.294E+00	5.211E-01	5.211E-01	4.823E-04
Type A	POINT	B064_02A	520,831.43	4,396,730.40	1686.69	13.41	608.93	9.29	0.61	1.294E+00	5.211E-01	5.211E-01	4.823E-04
Type A	POINT	B064_02B	520,831.43	4,396,734.99	1686.69	13.41	608.93	9.29	0.61	1.294E+00	5.211E-01	5.211E-01	4.823E-04
Type A	POINT	B064_01A	520,831.25	4,396,753.38	1686.69	13.41	608.93	9.29	0.61	1.294E+00	5.211E-01	5.211E-01	4.823E-04
Type A	POINT	B064_01B	520,831.24	4,396,757.97	1686.69	13.41	608.93	9.29	0.61	1.294E+00	5.211E-01	5.211E-01	4.823E-04
Type A	POINT	B063_04A	520,831.11	4,396,783.93	1686.69	13.41	608.93	9.29	0.61	1.294E+00	5.211E-01	5.211E-01	4.823E-04
Type A	POINT	B063_04B	520,831.11	4,396,788.53	1686.69	13.41	608.93	9.29	0.61	1.294E+00	5.211E-01	5.211E-01	4.823E-04
Type A	POINT	B063_03A	520,830.85	4,396,807.35	1686.69	13.41	608.93	9.29	0.61	1.294E+00	5.211E-01	5.211E-01	4.823E-04
Type A	POINT	B063_03B	520,830.85	4,396,811.94	1686.69	13.41	608.93	9.29	0.61	1.294E+00	5.211E-01	5.211E-01	4.823E-04
Type A	POINT	B063_02A	520,830.52	4,396,834.75	1686.69	13.41	608.93	9.29	0.61	1.294E+00	5.211E-01	5.211E-01	4.823E-04
Type A	POINT	B063_02B	520,830.52	4,396,839.35	1686.69	13.41	608.93	9.29	0.61	1.294E+00	5.211E-01	5.211E-01	4.823E-04
Type A	POINT	B063_01A	520,830.26	4,396,856.41	1686.69	13.41	608.93	9.29	0.61	1.294E+00	5.211E-01	5.211E-01	4.823E-04
Type A	POINT	B063_01B	520,830.26	4,396,861.00	1686.69	13.41	608.93	9.29	0.61	1.294E+00	5.211E-01	5.211E-01	4.823E-04
Type A	POINT	B063_21C	520,830.15	4,396,868.59	1686.69	13.41	608.93	9.29	0.61	1.294E+00	5.211E-01	5.211E-01	4.823E-04
Type A	POINT	B063_11C	520,830.23	4,396,876.64	1686.69	13.41	608.93	9.29	0.61	1.294E+00	5.211E-01	5.211E-01	4.823E-04
Type A	POINT	B065_01B	520,705.46	4,396,833.34	1686.69	13.41	608.93	9.29	0.61	1.294E+00	5.211E-01	5.211E-01	4.823E-04
Type A	POINT	B065_01A	520,700.86	4,396,833.33	1686.69	13.41	608.93	9.29	0.61	1.294E+00	5.211E-01	5.211E-01	4.823E-04
Type A	POINT	B065_02B	520,682.98	4,396,833.13	1686.69	13.41	608.93	9.29	0.61	1.294E+00	5.211E-01	5.211E-01	4.823E-04
Type A	POINT	B065_02A	520,678.39	4,396,833.13	1686.69	13.41	608.93	9.29	0.61	1.294E+00	5.211E-01	5.211E-01	4.823E-04
Type A	POINT	B065_03B	520,660.44	4,396,833.16	1686.69	13.41	608.93	9.29	0.61	1.294E+00	5.211E-01	5.211E-01	4.823E-04
Type A	POINT	B065_03A	520,655.85	4,396,833.15	1686.69	13.41	608.93	9.29	0.61	1.294E+00	5.211E-01	5.211E-01	4.823E-04
Type A	POINT	B065_04B	520,647.77	4,396,833.07	1686.69	13.41	608.93	9.29	0.61	1.294E+00	5.211E-01	5.211E-01	4.823E-04
Type A	POINT	B065_04A	520,643.18	4,396,833.06	1686.69	13.41	608.93	9.29	0.61	1.294E+00	5.211E-01	5.211E-01	4.823E-04

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Table B-2. Modeled Source Parameters (Preventive Maintenance Test Scenario)

Gen Type	Source Type *SRCTP*	Source ID	UTM Easting (m)	UTM Northing (m)	Elevation (m)	Stack Height *HGT* (m)	Temperature *TMP_1* (K)	Velocity *EXH_1* (m/s)	Exhaust Diameter *DIA* (m)	NO_x 1-hr (g/s)	CO 1-hr (g/s)	CO 8-hr (g/s)	$PM_{2.5}$ 24-hr (g/s)
Type C	POINT	B060_005	520,749.53	4,397,092.83	1686.33	4.67	567.93	12.73	0.46	2.654E+00	1.748E+00	1.748E+00	5.413E-03
Type C	POINT	B061_005	520,757.09	4,396,969.49	1686.33	11.89	567.93	12.73	0.46	2.654E+00	1.748E+00	1.748E+00	5.413E-03
Type C	POINT	B062_005	520,750.79	4,396,969.48	1686.33	11.89	567.93	12.73	0.46	2.654E+00	1.748E+00	1.748E+00	5.413E-03
Type C	POINT	B060_CE2	520,606.25	4,396,967.96	1686.33	11.89	567.93	12.73	0.46	2.654E+00	1.748E+00	1.748E+00	5.413E-03
Type C	POINT	B062_001	520,637.39	4,396,968.23	1686.33	11.89	567.93	12.73	0.46	2.654E+00	1.748E+00	1.748E+00	5.413E-03
Type C	POINT	B061_001	520,643.69	4,396,968.24	1686.33	11.89	567.93	12.73	0.46	2.654E+00	1.748E+00	1.748E+00	5.413E-03
Type C	POINT	B061_002	520,663.27	4,396,968.49	1686.33	11.89	567.93	12.73	0.46	2.654E+00	1.748E+00	1.748E+00	5.413E-03
Type C	POINT	B062_002	520,669.58	4,396,968.50	1686.33	11.89	567.93	12.73	0.46	2.654E+00	1.748E+00	1.748E+00	5.413E-03
Type C	POINT	B062_003	520,706.29	4,396,969.10	1686.33	11.89	567.93	12.73	0.46	2.654E+00	1.748E+00	1.748E+00	5.413E-03
Type C	POINT	B062_004	520,712.59	4,396,969.11	1686.33	11.89	567.93	12.73	0.46	2.654E+00	1.748E+00	1.748E+00	5.413E-03
Type C	POINT	B060_004	520,743.23	4,397,092.82	1686.33	4.67	567.93	12.73	0.46	2.654E+00	1.748E+00	1.748E+00	5.413E-03
Type C	POINT	B061_004	520,711.70	4,397,092.25	1686.33	4.67	567.93	12.73	0.46	2.654E+00	1.748E+00	1.748E+00	5.413E-03
Type C	POINT	B061_003	520,705.40	4,397,092.24	1686.33	4.67	567.93	12.73	0.46	2.654E+00	1.748E+00	1.748E+00	5.413E-03
Type C	POINT	B060_003	520,681.15	4,397,092.30	1686.33	4.67	567.93	12.73	0.46	2.654E+00	1.748E+00	1.748E+00	5.413E-03
Type C	POINT	B060_002	520,674.85	4,397,092.30	1686.33	4.67	567.93	12.73	0.46	2.654E+00	1.748E+00	1.748E+00	5.413E-03
Type C	POINT	B060_001	520,635.62	4,397,092.17	1686.33	4.67	567.93	12.73	0.46	2.654E+00	1.748E+00	1.748E+00	5.413E-03
Type C	POINT	B060_DE1	520,629.31	4,397,092.17	1686.33	4.67	567.93	12.73	0.46	2.654E+00	1.748E+00	1.748E+00	5.413E-03
Type C	POINT	B060_CE1	520,610.71	4,397,092.30	1686.33	4.67	567.93	12.73	0.46	2.654E+00	1.748E+00	1.748E+00	5.413E-03
Type B	POINT	B064_HSG	520,692.87	4,396,844.20	1686.69	13.41	562.48	21.28	0.36	8.147E-01	4.983E-01	4.983E-01	2.497E-03
Type A	POINT	B064_04A	520,831.92	4,396,681.26	1686.69	13.41	608.93	9.29	0.61	3.883E+00	1.563E+00	1.563E+00	1.447E-03
Type A	POINT	B064_04B	520,831.92	4,396,685.85	1686.69	13.41	608.93	9.29	0.61	3.883E+00	1.563E+00	1.563E+00	1.447E-03
Type A	POINT	B064_03A	520,831.76	4,396,704.38	1686.69	13.41	608.93	9.29	0.61	3.883E+00	1.563E+00	1.563E+00	1.447E-03
Type A	POINT	B064_03B	520,831.75	4,396,708.98	1686.69	13.41	608.93	9.29	0.61	3.883E+00	1.563E+00	1.563E+00	1.447E-03
Type A	POINT	B064_02A	520,831.43	4,396,730.40	1686.69	13.41	608.93	9.29	0.61	3.883E+00	1.563E+00	1.563E+00	1.447E-03
Type A	POINT	B064_02B	520,831.43	4,396,734.99	1686.69	13.41	608.93	9.29	0.61	3.883E+00	1.563E+00	1.563E+00	1.447E-03
Type A	POINT	B064_01A	520,831.25	4,396,753.38	1686.69	13.41	608.93	9.29	0.61	3.883E+00	1.563E+00	1.563E+00	1.447E-03
Type A	POINT	B064_01B	520,831.24	4,396,757.97	1686.69	13.41	608.93	9.29	0.61	3.883E+00	1.563E+00	1.563E+00	1.447E-03
Type A	POINT	B063_04A	520,831.11	4,396,783.93	1686.69	13.41	608.93	9.29	0.61	3.883E+00	1.563E+00	1.563E+00	1.447E-03
Type A	POINT	B063_04B	520,831.11	4,396,788.53	1686.69	13.41	608.93	9.29	0.61	3.883E+00	1.563E+00	1.563E+00	1.447E-03
Type A	POINT	B063_03A	520,830.85	4,396,807.35	1686.69	13.41	608.93	9.29	0.61	3.883E+00	1.563E+00	1.563E+00	1.447E-03
Type A	POINT	B063_03B	520,830.85	4,396,811.94	1686.69	13.41	608.93	9.29	0.61	3.883E+00	1.563E+00	1.563E+00	1.447E-03
Type A	POINT	B063_02A	520,830.52	4,396,834.75	1686.69	13.41	608.93	9.29	0.61	3.883E+00	1.563E+00	1.563E+00	1.447E-03
Type A	POINT	B063_02B	520,830.52	4,396,839.35	1686.69	13.41	608.93	9.29	0.61	3.883E+00	1.563E+00	1.563E+00	1.447E-03
Type A	POINT	B063_01A	520,830.26	4,396,856.41	1686.69	13.41	608.93	9.29	0.61	3.883E+00	1.563E+00	1.563E+00	1.447E-03
Type A	POINT	B063_01B	520,830.26	4,396,861.00	1686.69	13.41	608.93	9.29	0.61	3.883E+00	1.563E+00	1.563E+00	1.447E-03
Type A	POINT	B063_21C	520,830.15	4,396,868.59	1686.69	13.41	608.93	9.29	0.61	3.883E+00	1.563E+00	1.563E+00	1.447E-03
Type A	POINT	B063_11C	520,830.23	4,396,876.64	1686.69	13.41	608.93	9.29	0.61	3.883E+00	1.563E+00	1.563E+00	1.447E-03
Type A	POINT	B065_01B	520,705.46	4,396,833.34	1686.69	13.41	608.93	9.29	0.61	3.883E+00	1.563E+00	1.563E+00	1.447E-03
Type A	POINT	B065_01A	520,700.86	4,396,833.33	1686.69	13.41	608.93	9.29	0.61	3.883E+00	1.563E+00	1.563E+00	1.447E-03
Type A	POINT	B065_02B	520,682.98	4,396,833.13	1686.69	13.41	608.93	9.29	0.61	3.883E+00	1.563E+00	1.563E+00	1.447E-03
Type A	POINT	B065_02A	520,678.39	4,396,833.13	1686.69	13.41	608.93	9.29	0.61	3.883E+00	1.563E+00	1.563E+00	1.447E-03
Type A	POINT	B065_03B	520,660.44	4,396,833.16	1686.69	13.41	608.93	9.29	0.61	3.883E+00	1.563E+00	1.563E+00	1.447E-03
Type A	POINT	B065_03A	520,655.85	4,396,833.15	1686.69	13.41	608.93	9.29	0.61	3.883E+00	1.563E+00	1.563E+00	1.447E-03
Type A	POINT	B065_04B	520,647.77	4,396,833.07	1686.69	13.41	608.93	9.29	0.61	3.883E+00	1.563E+00	1.563E+00	1.447E-03
Type A	POINT	B065_04A	520,643.18	4,396,833.06	1686.69	13.41	608.93	9.29	0.61	3.883E+00	1.563E+00	1.563E+00	1.447E-03

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Table B-3. Modeled Source Parameters (Load Bank Test Scenario)

Gen Type	Source Type *SRCTP*	Source ID	UTM Easting (m)	UTM Northing (m)	Elevation (m)	Stack Height *HGT* (m)	Temperature *TMP_1* (K)	Velocity *EXH_1* (m/s)	Exhaust Diameter *DIA* (m)	NO_x 1-hr (g/s)	CO 1-hr (g/s)	CO 8-hr (g/s)	$PM_{2.5}$ 24-hr (g/s)
Type C	POINT	B060_005	520,749.53	4,397,092.83	1686.33	4.67	655.55	29.58	0.46	2.062E+00	4.019E-01	4.019E-01	2.019E-03
Type C	POINT	B061_005	520,757.09	4,396,969.49	1686.33	11.89	655.55	29.58	0.46	2.062E+00	4.019E-01	4.019E-01	2.019E-03
Type C	POINT	B062_005	520,750.79	4,396,969.48	1686.33	11.89	655.55	29.58	0.46	2.062E+00	4.019E-01	4.019E-01	2.019E-03
Type C	POINT	B060_CE2	520,606.25	4,396,967.96	1686.33	11.89	652.25	27.66	0.46	1.642E+00	3.832E-01	3.832E-01	1.995E-03
Type C	POINT	B062_001	520,637.39	4,396,968.23	1686.33	11.89	655.55	29.58	0.46	2.062E+00	4.019E-01	4.019E-01	2.019E-03
Type C	POINT	B061_001	520,643.69	4,396,968.24	1686.33	11.89	655.55	29.58	0.46	2.062E+00	4.019E-01	4.019E-01	2.019E-03
Type C	POINT	B061_002	520,663.27	4,396,968.49	1686.33	11.89	655.55	29.58	0.46	2.062E+00	4.019E-01	4.019E-01	2.019E-03
Type C	POINT	B062_002	520,669.58	4,396,968.50	1686.33	11.89	655.55	29.58	0.46	2.062E+00	4.019E-01	4.019E-01	2.019E-03
Type C	POINT	B062_003	520,706.29	4,396,969.10	1686.33	11.89	655.55	29.58	0.46	2.062E+00	4.019E-01	4.019E-01	2.019E-03
Type C	POINT	B062_004	520,712.59	4,396,969.11	1686.33	11.89	655.55	29.58	0.46	2.062E+00	4.019E-01	4.019E-01	2.019E-03
Type C	POINT	B060_004	520,743.23	4,397,092.82	1686.33	4.67	655.55	29.58	0.46	2.062E+00	4.019E-01	4.019E-01	2.019E-03
Type C	POINT	B061_004	520,711.70	4,397,092.25	1686.33	4.67	655.55	29.58	0.46	2.062E+00	4.019E-01	4.019E-01	2.019E-03
Type C	POINT	B061_003	520,705.40	4,397,092.24	1686.33	4.67	655.55	29.58	0.46	2.062E+00	4.019E-01	4.019E-01	2.019E-03
Type C	POINT	B060_003	520,681.15	4,397,092.30	1686.33	4.67	655.55	29.58	0.46	2.062E+00	4.019E-01	4.019E-01	2.019E-03
Type C	POINT	B060_002	520,674.85	4,397,092.30	1686.33	4.67	655.55	29.58	0.46	2.062E+00	4.019E-01	4.019E-01	2.019E-03
Type C	POINT	B060_001	520,635.62	4,397,092.17	1686.33	4.67	655.55	29.58	0.46	2.062E+00	4.019E-01	4.019E-01	2.019E-03
Type C	POINT	B060_DE1	520,629.31	4,397,092.17	1686.33	4.67	655.55	29.58	0.46	2.062E+00	4.019E-01	4.019E-01	2.019E-03
Type C	POINT	B060_CE1	520,610.71	4,397,092.30	1686.33	4.67	652.25	27.66	0.46	1.642E+00	3.832E-01	3.832E-01	1.995E-03
Type B	POINT	B064_HSG	520,692.87	4,396,844.20	1686.69	13.41	606.54	42.96	0.36	1.691E+00	3.277E-01	3.277E-01	2.026E-03
Type A	POINT	B064_04A	520,831.92	4,396,681.26	1686.69	13.41	690.09	20.13	0.61	1.471E+00	3.097E-01	3.097E-01	6.998E-04
Type A	POINT	B064_04B	520,831.92	4,396,685.85	1686.69	13.41	690.09	20.13	0.61	1.471E+00	3.097E-01	3.097E-01	6.998E-04
Type A	POINT	B064_03A	520,831.76	4,396,704.38	1686.69	13.41	690.09	20.13	0.61	1.471E+00	3.097E-01	3.097E-01	6.998E-04
Type A	POINT	B064_03B	520,831.75	4,396,708.98	1686.69	13.41	690.09	20.13	0.61	1.471E+00	3.097E-01	3.097E-01	6.998E-04
Type A	POINT	B064_02A	520,831.43	4,396,730.40	1686.69	13.41	690.09	20.13	0.61	1.471E+00	3.097E-01	3.097E-01	6.998E-04
Type A	POINT	B064_02B	520,831.43	4,396,734.99	1686.69	13.41	690.09	20.13	0.61	1.471E+00	3.097E-01	3.097E-01	6.998E-04
Type A	POINT	B064_01A	520,831.25	4,396,753.38	1686.69	13.41	690.09	20.13	0.61	1.471E+00	3.097E-01	3.097E-01	6.998E-04
Type A	POINT	B064_01B	520,831.24	4,396,757.97	1686.69	13.41	690.09	20.13	0.61	1.471E+00	3.097E-01	3.097E-01	6.998E-04
Type A	POINT	B063_04A	520,831.11	4,396,783.93	1686.69	13.41	690.09	20.13	0.61	1.471E+00	3.097E-01	3.097E-01	6.998E-04
Type A	POINT	B063_04B	520,831.11	4,396,788.53	1686.69	13.41	690.09	20.13	0.61	1.471E+00	3.097E-01	3.097E-01	6.998E-04
Type A	POINT	B063_03A	520,830.85	4,396,807.35	1686.69	13.41	690.09	20.13	0.61	1.471E+00	3.097E-01	3.097E-01	6.998E-04
Type A	POINT	B063_03B	520,830.85	4,396,811.94	1686.69	13.41	690.09	20.13	0.61	1.471E+00	3.097E-01	3.097E-01	6.998E-04
Type A	POINT	B063_02A	520,830.52	4,396,834.75	1686.69	13.41	690.09	20.13	0.61	1.471E+00	3.097E-01	3.097E-01	6.998E-04
Type A	POINT	B063_02B	520,830.52	4,396,839.35	1686.69	13.41	690.09	20.13	0.61	1.471E+00	3.097E-01	3.097E-01	6.998E-04
Type A	POINT	B063_01A	520,830.26	4,396,856.41	1686.69	13.41	690.09	20.13	0.61	1.471E+00	3.097E-01	3.097E-01	6.998E-04
Type A	POINT	B063_01B	520,830.26	4,396,861.00	1686.69	13.41	690.09	20.13	0.61	1.471E+00	3.097E-01	3.097E-01	6.998E-04
Type A	POINT	B063_21C	520,830.15	4,396,868.59	1686.69	13.41	689.05	18.90	0.61	1.435E+00	2.993E-01	2.993E-01	6.775E-04
Type A	POINT	B063_11C	520,830.23	4,396,876.64	1686.69	13.41	689.05	18.90	0.61	1.435E+00	2.993E-01	2.993E-01	6.775E-04
Type A	POINT	B065_01B	520,705.46	4,396,833.34	1686.69	13.41	690.09	20.13	0.61	1.471E+00	3.097E-01	3.097E-01	6.998E-04
Type A	POINT	B065_01A	520,700.86	4,396,833.33	1686.69	13.41	690.09	20.13	0.61	1.471E+00	3.097E-01	3.097E-01	6.998E-04
Type A	POINT	B065_02B	520,682.98	4,396,833.13	1686.69	13.41	690.09	20.13	0.61	1.471E+00	3.097E-01	3.097E-01	6.998E-04
Type A	POINT	B065_02A	520,678.39	4,396,833.13	1686.69	13.41	690.09	20.13	0.61	1.471E+00	3.097E-01	3.097E-01	6.998E-04
Type A	POINT	B065_03B	520,660.44	4,396,833.16	1686.69	13.41	690.09	20.13	0.61	1.471E+00	3.097E-01	3.097E-01	6.998E-04
Type A	POINT	B065_03A	520,655.85	4,396,833.15	1686.69	13.41	690.09	20.13	0.61	1.471E+00	3.097E-01	3.097E-01	6.998E-04
Type A	POINT	B065_04B	520,647.77	4,396,833.07	1686.69	13.41	690.09	20.13	0.61	1.471E+00	3.097E-01	3.097E-01	6.998E-04
Type A	POINT	B065_04A	520,643.18	4,396,833.06	1686.69	13.41	690.09	20.13	0.61	1.471E+00	3.097E-01	3.097E-01	6.998E-04

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Table B-4. Modeled Source Parameters (Annual Live Load Transfer Test Scenario)

Gen Type	Source Type *SRCTP*	Source ID	UTM Easting (m)	UTM Northing (m)	Elevation (m)	Stack Height *HGT* (m)	Temperature *TMP_1* (K)	Velocity *EXH_1* (m/s)	Exhaust Diameter *DIA* (m)	NO_x 1-hr (g/s)	CO 1-hr (g/s)	CO 8-hr (g/s)	$PM_{2.5}$ 24-hr (g/s)
Type C	POINT	B060_005	520,749.53	4,397,092.83	1686.33	4.67	709.04	47.06	0.46	4.884E+00	4.347E-01	4.347E-01	2.245E-03
Type C	POINT	B061_005	520,757.09	4,396,969.49	1686.33	11.89	709.04	47.06	0.46	4.884E+00	4.347E-01	4.347E-01	2.245E-03
Type C	POINT	B062_005	520,750.79	4,396,969.48	1686.33	11.89	709.04	47.06	0.46	4.884E+00	4.347E-01	4.347E-01	2.245E-03
Type C	POINT	B060_CE2	520,606.25	4,396,967.96	1686.33	11.89	709.04	47.06	0.46	4.884E+00	4.347E-01	4.347E-01	2.245E-03
Type C	POINT	B062_001	520,637.39	4,396,968.23	1686.33	11.89	709.04	47.06	0.46	4.884E+00	4.347E-01	4.347E-01	2.245E-03
Type C	POINT	B061_001	520,643.69	4,396,968.24	1686.33	11.89	709.04	47.06	0.46	4.884E+00	4.347E-01	4.347E-01	2.245E-03
Type C	POINT	B061_002	520,663.27	4,396,968.49	1686.33	11.89	709.04	47.06	0.46	4.884E+00	4.347E-01	4.347E-01	2.245E-03
Type C	POINT	B062_002	520,669.58	4,396,968.50	1686.33	11.89	709.04	47.06	0.46	4.884E+00	4.347E-01	4.347E-01	2.245E-03
Type C	POINT	B062_003	520,706.29	4,396,969.10	1686.33	11.89	709.04	47.06	0.46	4.884E+00	4.347E-01	4.347E-01	2.245E-03
Type C	POINT	B062_004	520,712.59	4,396,969.11	1686.33	11.89	709.04	47.06	0.46	4.884E+00	4.347E-01	4.347E-01	2.245E-03
Type C	POINT	B060_004	520,743.23	4,397,092.82	1686.33	4.67	709.04	47.06	0.46	4.884E+00	4.347E-01	4.347E-01	2.245E-03
Type C	POINT	B061_004	520,711.70	4,397,092.25	1686.33	4.67	709.04	47.06	0.46	4.884E+00	4.347E-01	4.347E-01	2.245E-03
Type C	POINT	B061_003	520,705.40	4,397,092.24	1686.33	4.67	709.04	47.06	0.46	4.884E+00	4.347E-01	4.347E-01	2.245E-03
Type C	POINT	B060_003	520,681.15	4,397,092.30	1686.33	4.67	709.04	47.06	0.46	4.884E+00	4.347E-01	4.347E-01	2.245E-03
Type C	POINT	B060_002	520,674.85	4,397,092.30	1686.33	4.67	709.04	47.06	0.46	4.884E+00	4.347E-01	4.347E-01	2.245E-03
Type C	POINT	B060_001	520,635.62	4,397,092.17	1686.33	4.67	709.04	47.06	0.46	4.884E+00	4.347E-01	4.347E-01	2.245E-03
Type C	POINT	B060_DE1	520,629.31	4,397,092.17	1686.33	4.67	709.04	47.06	0.46	4.884E+00	4.347E-01	4.347E-01	2.245E-03
Type C	POINT	B060_CE1	520,610.71	4,397,092.30	1686.33	4.67	709.04	47.06	0.46	4.884E+00	4.347E-01	4.347E-01	2.245E-03
Type B	POINT	B064_HSG	520,692.87	4,396,844.20	1686.69	13.41	645.98	65.43	0.36	3.753E+00	3.042E-01	3.042E-01	1.809E-03
Type A	POINT	B064_04A	520,831.92	4,396,681.26	1686.69	13.41	728.43	31.33	0.61	2.804E+00	3.719E-01	3.719E-01	9.115E-04
Type A	POINT	B064_04B	520,831.92	4,396,685.85	1686.69	13.41	728.43	31.33	0.61	2.804E+00	3.719E-01	3.719E-01	9.115E-04
Type A	POINT	B064_03A	520,831.76	4,396,704.38	1686.69	13.41	728.43	31.33	0.61	2.804E+00	3.719E-01	3.719E-01	9.115E-04
Type A	POINT	B064_03B	520,831.75	4,396,708.98	1686.69	13.41	728.43	31.33	0.61	2.804E+00	3.719E-01	3.719E-01	9.115E-04
Type A	POINT	B064_02A	520,831.43	4,396,730.40	1686.69	13.41	728.43	31.33	0.61	2.804E+00	3.719E-01	3.719E-01	9.115E-04
Type A	POINT	B064_02B	520,831.43	4,396,734.99	1686.69	13.41	728.43	31.33	0.61	2.804E+00	3.719E-01	3.719E-01	9.115E-04
Type A	POINT	B064_01A	520,831.25	4,396,753.38	1686.69	13.41	728.43	31.33	0.61	2.804E+00	3.719E-01	3.719E-01	9.115E-04
Type A	POINT	B064_01B	520,831.24	4,396,757.97	1686.69	13.41	728.43	31.33	0.61	2.804E+00	3.719E-01	3.719E-01	9.115E-04
Type A	POINT	B063_04A	520,831.11	4,396,783.93	1686.69	13.41	728.43	31.33	0.61	2.804E+00	3.719E-01	3.719E-01	9.115E-04
Type A	POINT	B063_04B	520,831.11	4,396,788.53	1686.69	13.41	728.43	31.33	0.61	2.804E+00	3.719E-01	3.719E-01	9.115E-04
Type A	POINT	B063_03A	520,830.85	4,396,807.35	1686.69	13.41	728.43	31.33	0.61	2.804E+00	3.719E-01	3.719E-01	9.115E-04
Type A	POINT	B063_03B	520,830.85	4,396,811.94	1686.69	13.41	728.43	31.33	0.61	2.804E+00	3.719E-01	3.719E-01	9.115E-04
Type A	POINT	B063_02A	520,830.52	4,396,834.75	1686.69	13.41	728.43	31.33	0.61	2.804E+00	3.719E-01	3.719E-01	9.115E-04
Type A	POINT	B063_02B	520,830.52	4,396,839.35	1686.69	13.41	728.43	31.33	0.61	2.804E+00	3.719E-01	3.719E-01	9.115E-04
Type A	POINT	B063_01A	520,830.26	4,396,856.41	1686.69	13.41	728.43	31.33	0.61	2.804E+00	3.719E-01	3.719E-01	9.115E-04
Type A	POINT	B063_01B	520,830.26	4,396,861.00	1686.69	13.41	728.43	31.33	0.61	2.804E+00	3.719E-01	3.719E-01	9.115E-04
Type A	POINT	B063_21C	520,830.15	4,396,868.59	1686.69	13.41	728.43	31.33	0.61	2.804E+00	3.719E-01	3.719E-01	9.115E-04
Type A	POINT	B063_11C	520,830.23	4,396,876.64	1686.69	13.41	728.43	31.33	0.61	2.804E+00	3.719E-01	3.719E-01	9.115E-04
Type A	POINT	B065_01B	520,705.46	4,396,833.34	1686.69	13.41	728.43	31.33	0.61	2.804E+00	3.719E-01	3.719E-01	9.115E-04
Type A	POINT	B065_01A	520,700.86	4,396,833.33	1686.69	13.41	728.43	31.33	0.61	2.804E+00	3.719E-01	3.719E-01	9.115E-04
Type A	POINT	B065_02B	520,682.98	4,396,833.13	1686.69	13.41	728.43	31.33	0.61	2.804E+00	3.719E-01	3.719E-01	9.115E-04
Type A	POINT	B065_02A	520,678.39	4,396,833.13	1686.69	13.41	728.43	31.33	0.61	2.804E+00	3.719E-01	3.719E-01	9.115E-04
Type A	POINT	B065_03B	520,660.44	4,396,833.16	1686.69	13.41	728.43	31.33	0.61	2.804E+00	3.719E-01	3.719E-01	9.115E-04
Type A	POINT	B065_03A	520,655.85	4,396,833.15	1686.69	13.41	728.43	31.33	0.61	2.804E+00	3.719E-01	3.719E-01	9.115E-04
Type A	POINT	B065_04B	520,647.77	4,396,833.07	1686.69	13.41	728.43	31.33	0.61	2.804E+00	3.719E-01	3.719E-01	9.115E-04
Type A	POINT	B065_04A	520,643.18	4,396,833.06	1686.69	13.41	728.43	31.33	0.61	2.804E+00	3.719E-01	3.719E-01	9.115E-04

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Table B-5. Modeled Building Parameters

Building ID	UTM Easting (m)	UTM Northing (m)	Elevation (m)	Stack Height (m)
B060MN01	520,561.23	4,397,054.67	1,686.33	7.92
B060MN02	520,599.98	4,397,071.10	1,686.33	4.88
B060MN03	520,677.66	4,397,071.70	1,686.33	5.55
B060MN04	520,600.71	4,397,033.26	1,686.33	4.88
B060MN05	520,678.39	4,397,033.86	1,686.33	5.55
B060MN06	520,600.71	4,397,005.71	1,686.33	4.88
B060MN07	520,678.39	4,397,006.31	1,686.33	5.55
B060MN08	520,611.25	4,397,054.60	1,686.33	4.88
B060MN09	520,611.61	4,397,016.75	1,686.33	4.88
B060MN10	520,600.70	4,397,026.92	1,686.33	4.88
B060CE1E	520,612.99	4,397,101.32	1,686.33	4.22
B060DE1E	520,631.60	4,397,101.19	1,686.33	4.22
B060001E	520,637.90	4,397,101.20	1,686.33	4.22
B060002E	520,677.14	4,397,101.32	1,686.33	4.22
B060003E	520,683.44	4,397,101.33	1,686.33	4.22
B061003E	520,707.69	4,397,101.27	1,686.33	4.22
B061004E	520,713.99	4,397,101.28	1,686.33	4.22
B060004E	520,745.52	4,397,101.84	1,686.33	4.22
B060005E	520,751.82	4,397,101.85	1,686.33	4.22
B061005E	520,754.80	4,396,960.41	1,686.33	4.22
B062005E	520,748.50	4,396,960.41	1,686.33	4.22
B062004E	520,710.31	4,396,960.04	1,686.33	4.22
B062003E	520,704.00	4,396,960.03	1,686.33	4.22
B062002E	520,667.29	4,396,959.42	1,686.33	4.22
B061002E	520,660.99	4,396,959.42	1,686.33	4.22
B061001E	520,641.40	4,396,959.17	1,686.33	4.22
B062001E	520,635.10	4,396,959.16	1,686.33	4.22
B060CE2E	520,603.96	4,396,958.88	1,686.33	4.22
B064MAIN	520,725.60	4,396,669.43	1,686.69	11.05
B06404AE	520,829.63	4,396,678.96	1,686.69	5.72
B06404AS	520,829.62	4,396,683.55	1,686.69	10.26
B06404BE	520,829.62	4,396,683.55	1,686.69	5.72
B06404BS	520,829.62	4,396,688.14	1,686.69	10.26
B06403AE	520,829.47	4,396,702.08	1,686.69	5.72
B06403AS	520,829.46	4,396,706.68	1,686.69	10.26
B06403BE	520,829.46	4,396,706.68	1,686.69	5.72
B06403BS	520,829.45	4,396,711.27	1,686.69	10.26
B06402AE	520,829.14	4,396,728.10	1,686.69	5.72
B06402AS	520,829.13	4,396,732.69	1,686.69	10.26
B06402BE	520,829.13	4,396,732.69	1,686.69	5.72
B06402BS	520,829.13	4,396,737.29	1,686.69	10.26
B06401AE	520,828.95	4,396,751.08	1,686.69	5.72
B06401AS	520,828.95	4,396,755.68	1,686.69	10.26
B06401BE	520,828.95	4,396,755.67	1,686.69	5.72
B06401BS	520,828.94	4,396,760.27	1,686.69	10.26
B06304AE	520,828.82	4,396,781.63	1,686.69	5.72
B06304AS	520,828.81	4,396,786.23	1,686.69	10.26
B06304BE	520,828.81	4,396,786.23	1,686.69	5.72
B06304BS	520,828.81	4,396,790.82	1,686.69	10.26
B06303AE	520,828.56	4,396,805.05	1,686.69	5.72
B06303AS	520,828.55	4,396,809.65	1,686.69	10.26
B06303BE	520,828.55	4,396,809.64	1,686.69	5.72
B06303BS	520,828.55	4,396,814.24	1,686.69	10.26
B06302AE	520,828.23	4,396,832.45	1,686.69	5.72
B06302AS	520,828.22	4,396,837.05	1,686.69	10.26
B06302BE	520,828.22	4,396,837.05	1,686.69	5.72
B06302BS	520,828.22	4,396,841.64	1,686.69	10.26
B06301AE	520,827.97	4,396,854.11	1,686.69	5.72
B06301AS	520,827.96	4,396,858.70	1,686.69	10.26
B06301BE	520,827.96	4,396,858.70	1,686.69	5.72
B06301BS	520,827.96	4,396,863.30	1,686.69	10.26
B06321CE	520,827.86	4,396,866.29	1,686.69	5.72
B06321CS	520,827.86	4,396,870.89	1,686.69	10.26
B06311CE	520,827.94	4,396,874.34	1,686.69	5.72
B06311CS	520,827.93	4,396,878.94	1,686.69	10.26
B06501BE	520,703.16	4,396,835.63	1,686.69	5.72
B06501BS	520,707.75	4,396,835.64	1,686.69	10.26
B06501AE	520,698.56	4,396,835.63	1,686.69	5.72
B06501AS	520,703.16	4,396,835.63	1,686.69	10.26
B06502BE	520,680.68	4,396,835.42	1,686.69	5.72
B06502BS	520,685.28	4,396,835.43	1,686.69	10.26
B06502AE	520,676.09	4,396,835.42	1,686.69	5.72
B06502AS	520,680.69	4,396,835.43	1,686.69	10.26
B06503BE	520,658.14	4,396,835.45	1,686.69	5.72
B06503BS	520,662.74	4,396,835.46	1,686.69	10.26
B06503AE	520,653.55	4,396,835.44	1,686.69	5.72
B06503AS	520,658.14	4,396,835.45	1,686.69	10.26
B06504BE	520,645.47	4,396,835.36	1,686.69	5.72
B06504BS	520,650.07	4,396,835.37	1,686.69	10.26
B06504AE	520,640.88	4,396,835.35	1,686.69	5.72
B06504AS	520,645.47	4,396,835.36	1,686.69	10.26
H2OTNK01	520,800.58	4,397,069.47	1,686.33	9.14
H2OTNK02	520,795.07	4,397,069.40	1,686.33	9.14
H2OTNK03	520,789.52	4,397,069.32	1,686.33	9.14
H2OTNK04	520,784.11	4,397,069.23	1,686.33	9.14
H2OTNK05	520,800.58	4,397,062.04	1,686.33	9.14
H2OTNK06	520,795.07	4,397,061.97	1,686.33	9.14
H2OTNK07	520,789.52	4,397,061.88	1,686.33	9.14
H2OTNK08	520,784.11	4,397,061.79	1,686.33	9.14
H2OTNK09	520,801.14	4,396,994.63	1,686.33	9.14
H2OTNK10	520,795.63	4,396,994.56	1,686.33	9.14
H2OTNK11	520,790.08	4,396,994.48	1,686.33	9.14
H2OTNK12	520,784.67	4,396,994.39	1,686.33	9.14
H2OTNK13	520,717.82	4,396,858.05	1,686.69	13.41
H2OTNK14	520,717.94	4,396,848.41	1,686.69	13.41
H2OTNK15	520,718.08	4,396,838.71	1,686.69	13.41
H2OTNK16	520,718.24	4,396,829.25	1,686.69	13.41
B064HSGE	520,690.87	4,396,850.45	1,686.69	5.08

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APPENDIX C. ELECTRONIC MODELING FILES

Files submitted electronically only. A file directory is included below.

Appendix Table C-1. Modeling File Directory

Folder Name	File Name	File Contents
aermod.20251017.no2.01hour.ct6.grsm.cumulative	apa060.no2.01hour.5Y.in	NO_2 model input file for confidence testing scenario
	apa060.no2.01hour.5Y.max	Worst case modeled source group concentration for the testing scenario
	apa060.no2.01hour.5Y.top	Plot file results of worst case modeled source group, per receptor for the testing scenario
	plot.files.zip	Model plot files
	out.files.zip	Model output files
	Include Folder	Include files outlined below
aermod.20251017.no2.01hour.lbt.grsm.cumulative	Folder contains same files as NO_2 ct6 folder above*	NO_2 model inputs and results for load bank testing scenario
aermod.20251017.no2.01hour.llt.grsm.cumulative	Folder contains same files as NO_2 ct6 folder above*	NO_2 model inputs and results for live load testing scenario
aermod.20251017.no2.01hour.pmt.grsm.cumulative	Folder contains same files as NO_2 ct6 folder above*	NO_2 model inputs and results for preventative maintenance testing scenario
aermod.20251005.pm25.24hour.ct6	apa060.pm25.24hour.5Y.in	$PM_{2.5}$ model input files for confidence testing scenario
	apa060.pm25.24hour.5Y.max	Worst case modeled scenario concentration
	apa060.pm25.24hour.5Y.top	Worst case modeled scenario concentration
	plot.files.zip	Model plot files
	out.files.zip	Model output files
	Include Folder	Include files outlined below
aermod.20251005.pm25.24hour.lbt	Folder contains same files as $PM_{2.5}$ ct6 folder above*	$PM_{2.5}$ model inputs and results for load bank testing scenario
aermod.20251005.pm25.24hour.llt	Folder contains same files as $PM_{2.5}$ ct6 folder above*	$PM_{2.5}$ model inputs and results for live load testing scenario
aermod.20251005.pm25.24hour.pmt	Folder contains same files as $PM_{2.5}$ ct6 folder above*	$PM_{2.5}$ model inputs and results preventative maintenance testing scenario

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Folder Name	File Name	File Contents
aermod.20251005.co.01hour.ct6	apa060.co.01hour.5Y.in	CO model input files for confidence testing scenario
	apa060.co.01hour.5Y.max	Worst case modeled scenario concentration
	apa060.co.01hour.5Y.top	Worst case modeled scenario concentration
	plot.files.zip	Model plot files
	out.files.zip	Model output files
	Include Folder	Include files outlined below
aermod.20251005.co.01hour.lbt	Folder contains same files as CO ct6 folder above*	CO model inputs and results for load bank testing scenario
aermod.20251005.co.01hour.llt	Folder contains same files as CO ct6 folder above*	CO model inputs and results for live load testing scenario
aermod.20251005.co.01hour.pmt	Folder contains same files as CO ct6 folder above*	CO model inputs and results preventative maintenance testing scenario
aermod.20251005.co.08hour.ct6	apa060.co.08hour.5Y.in	CO model input files for confidence testing scenario
	apa060.co.08hour.5Y.max	Worst case modeled scenario concentration
	apa060.co.08hour.5Y.top	Worst case modeled scenario concentration
	plot.files.zip	Model plot files
	out.files.zip	Model output files
	Include Folder	Include files outlined below
aermod.20251005.co.08hour.lbt	Folder contains same files as CO ct6 folder above*	CO model inputs and results for load bank testing scenario
aermod.20251005.co.08hour.llt	Folder contains same files as CO ct6 folder above*	CO model inputs and results for live load testing scenario
aermod.20251005.co.08hour.pmt	Folder contains same files as CO ct6 folder above*	CO model inputs and results preventative maintenance testing scenario
aermet	DIA_adju_v24142.pfl DIA_adju_v24142..sfc	Meteorological surface and profile data
aqs	bckgrnd.lst 2017-2021_LaCasa_O3.txt 2017-2021_LaCasa_NOx.txt LaCasa_O3_Subs_2017-2021.dat LaCasa_NOx_Subs_2017-2021.dat	Ozone and NOx background concentration

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Folder Name	File Name	File Contents
aermap	XXXXmXYYYYm Boundary.bln terrain_domain	Discrete and boundary receptor information where XXXXm represents receptor spacing and YYYYm represents receptor extent. Terrain file for selected domain.
Include	BPIP Folder	BPIP files specified below
	emfac.lst	Variable emission rates adjusting for the length of each scheduled run per scenario
	isr.lst	In-stack ratio
	apa060.no2.01hour.srcs, pm25.24hour.srcs, co.01hour.srcs, OR co.08hour.srcs	File including source locations, elevations, emission rates, and stack exhaust parameters.
	srcgrp.lst	Source groups
BPIP	bpip.in bpip.out	Building profile data input and output data

* Each folder contains all modeling input files that are unique to the modeled T&M scenario. The file names are the same between folders but contain information specifically for that test.